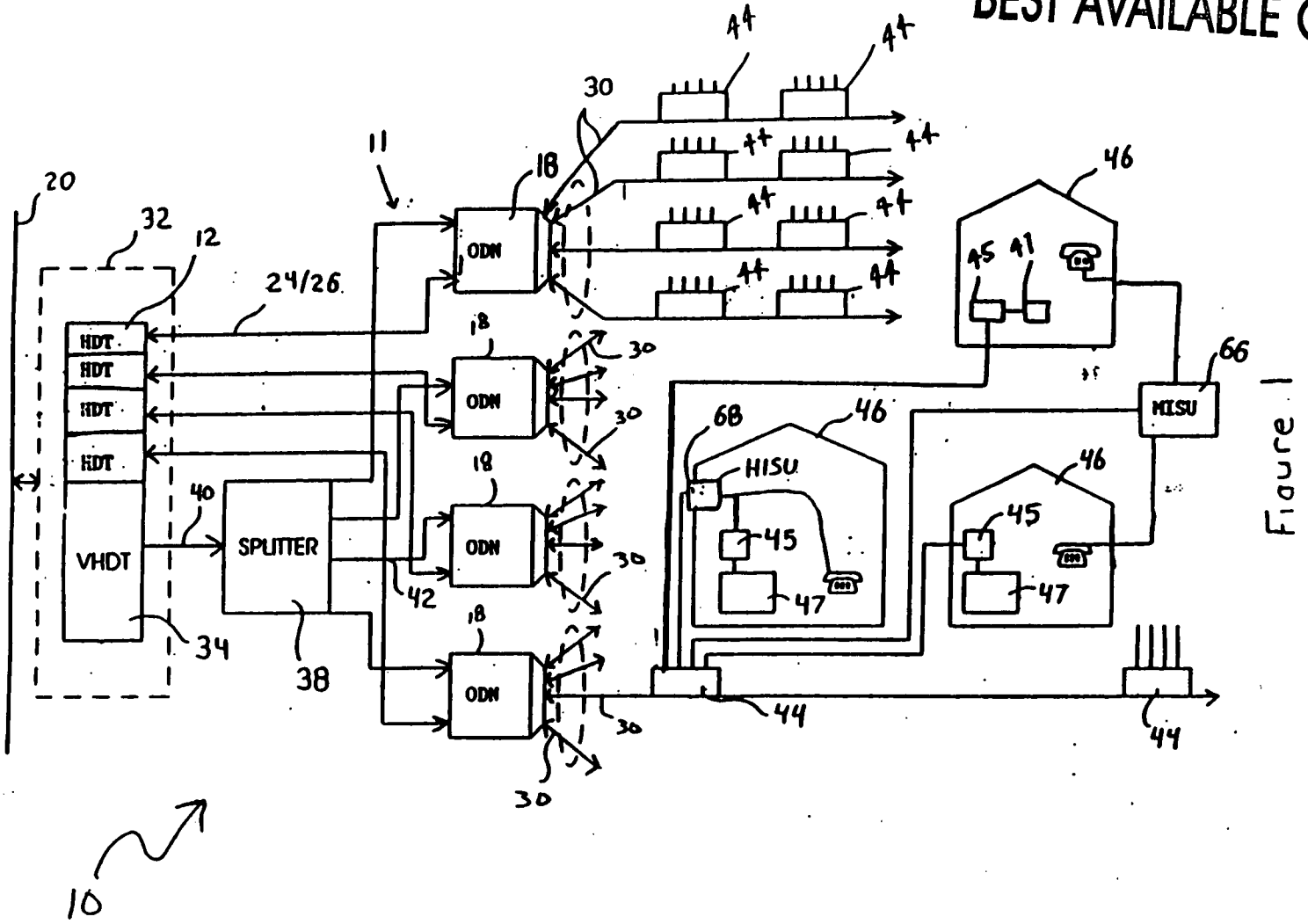


Figure 1

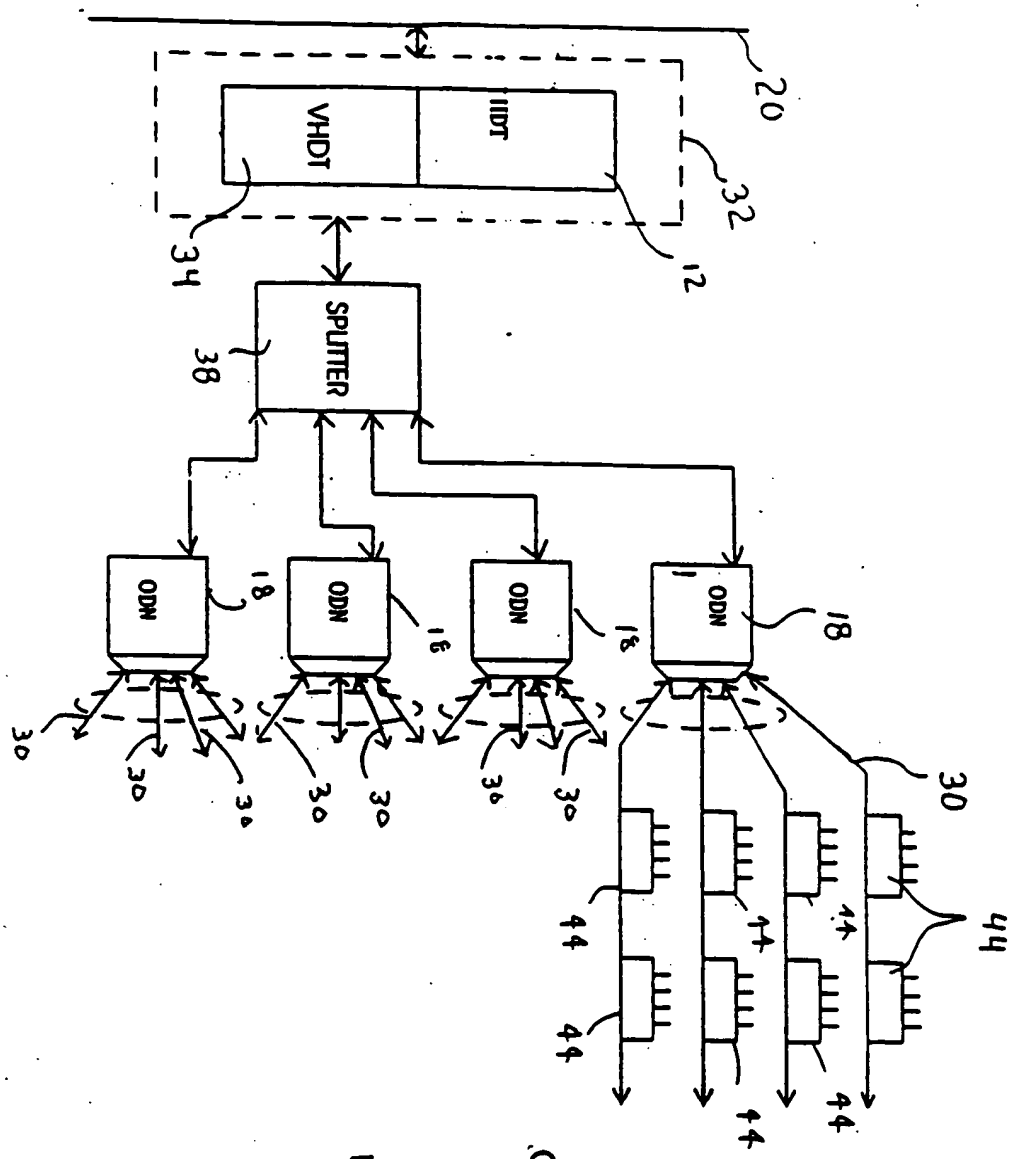


Figure 2

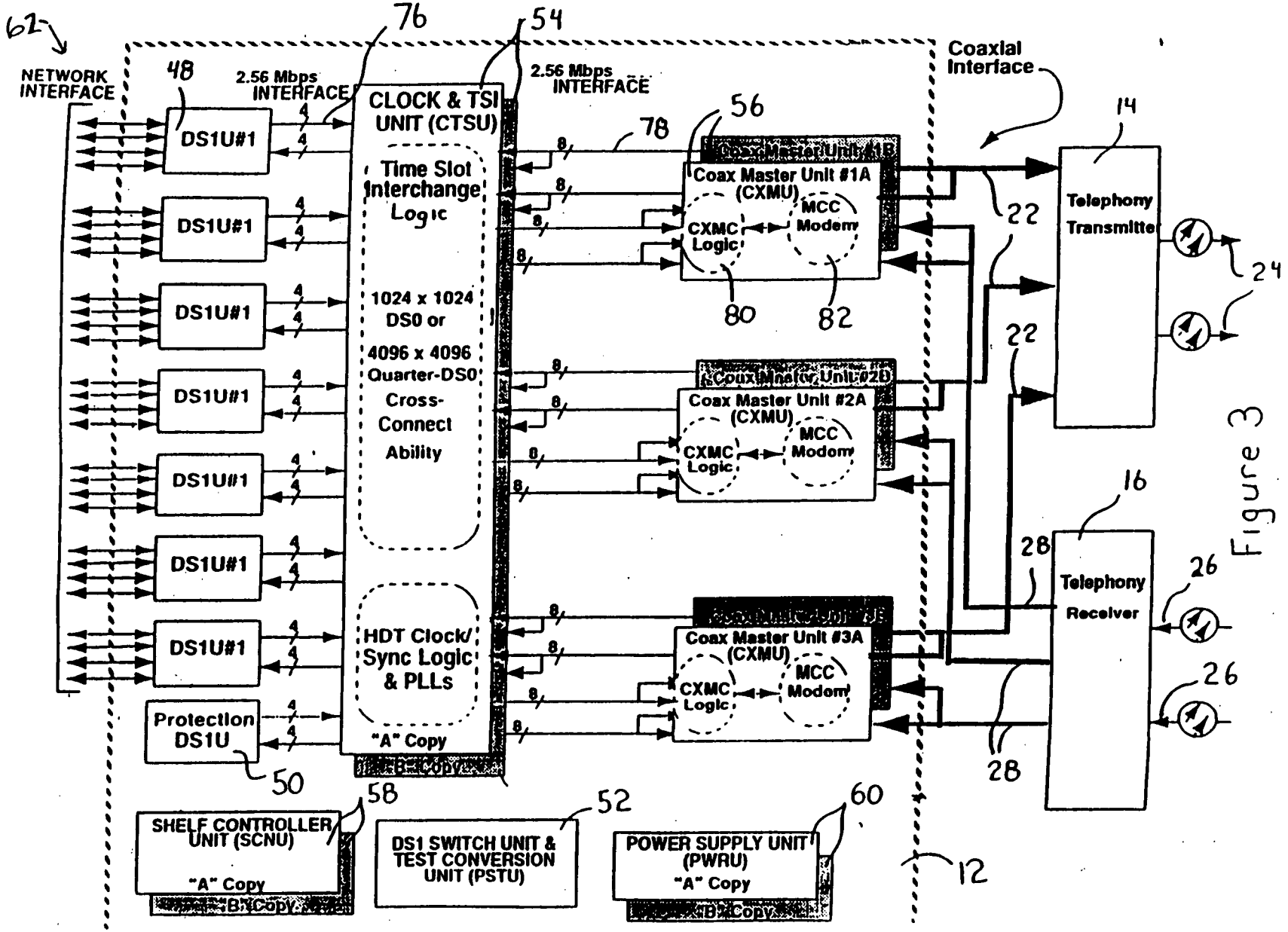


Figure 3

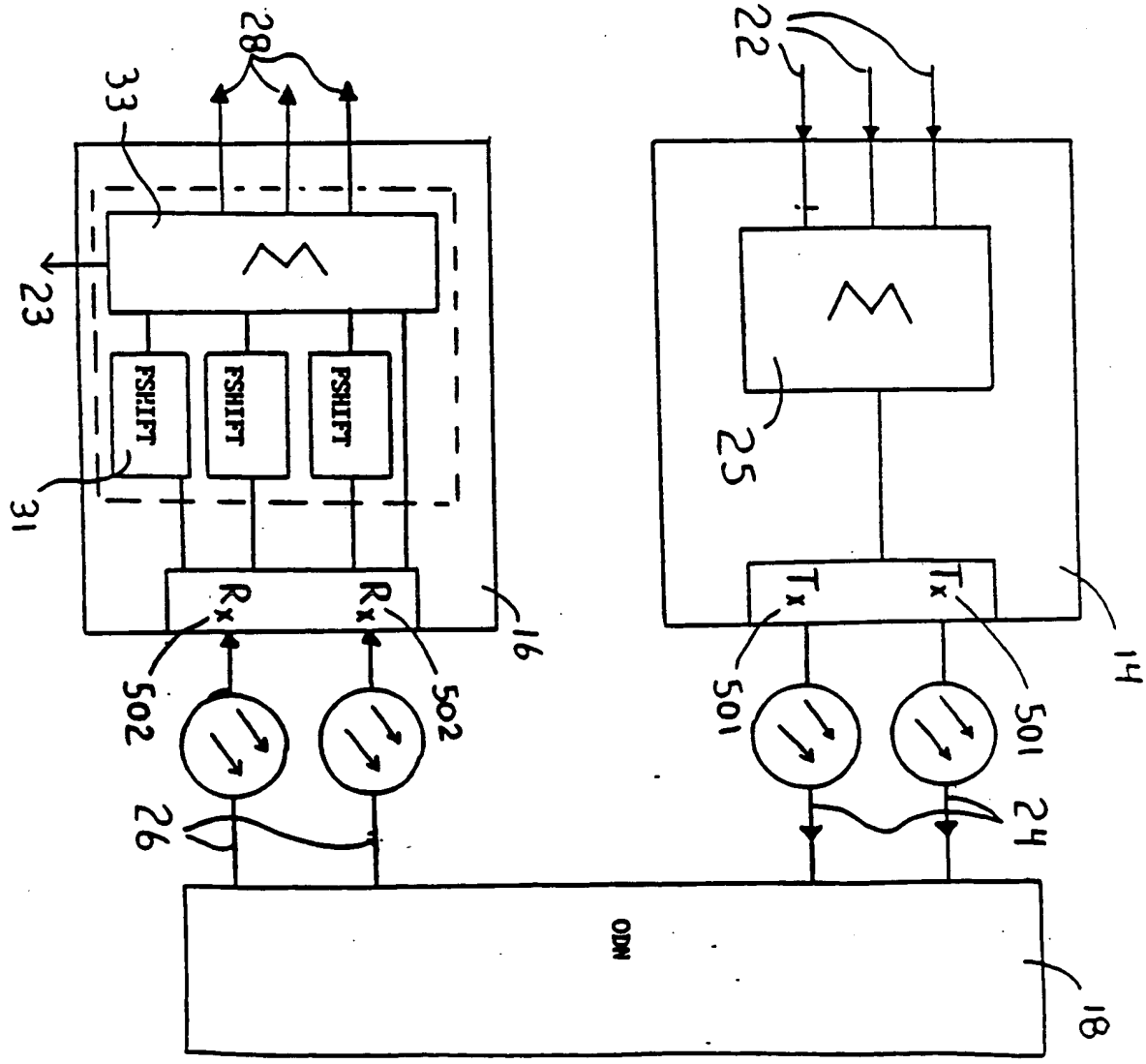

22
28
33
23
FSHIFT
FSHIFT
FSHIFT
31
25
Rx
Rx
Tx
Tx
16
14
502
502
501
501
26
24
ODN
18

Figure 4

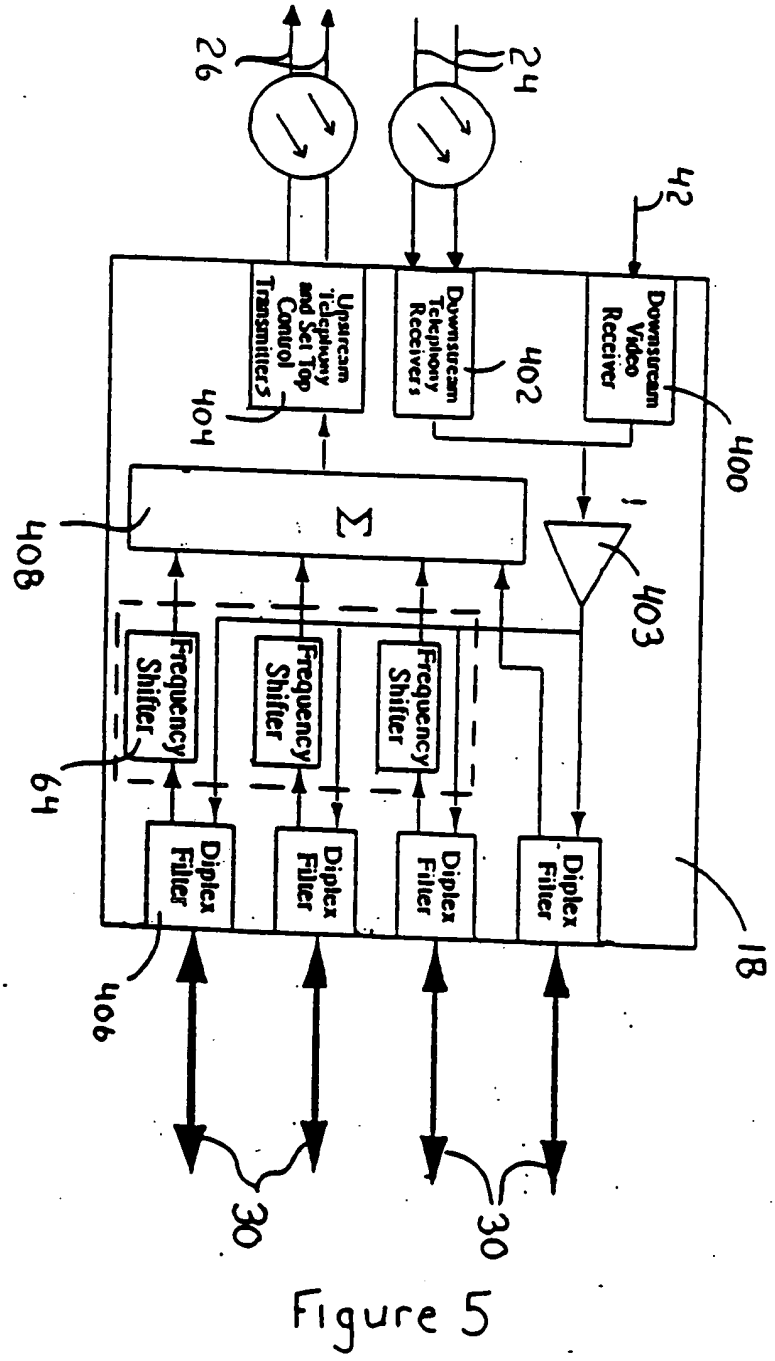

26
24
42
Upstream Telephony and Set Top Control Transmitters
Downstream Telephony Receivers
Downstream Video Receiver
402
404
400
Σ
408
403
Frequency Shifter
Frequency Shifter
Frequency Shifter
64
Diplex Filter
Diplex Filter
Diplex Filter
Diplex Filter
406
18
30
30

Figure 5

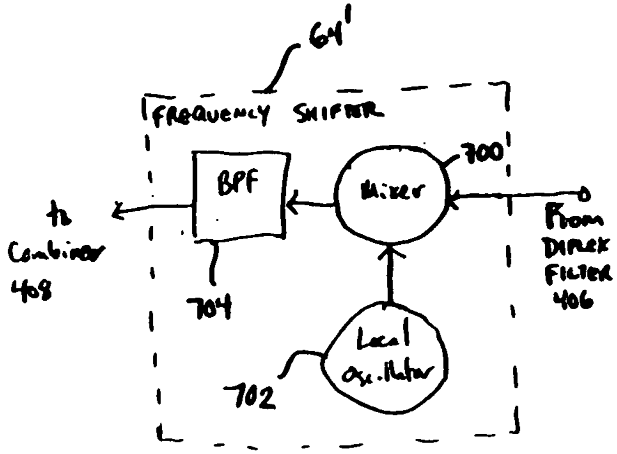

64'
FREQUENCY SHIFTER
BPF
Mixer
700
Local Oscillator
702
704
To Combiner 408
From DIPLEX FILTER 406

Fig. 7

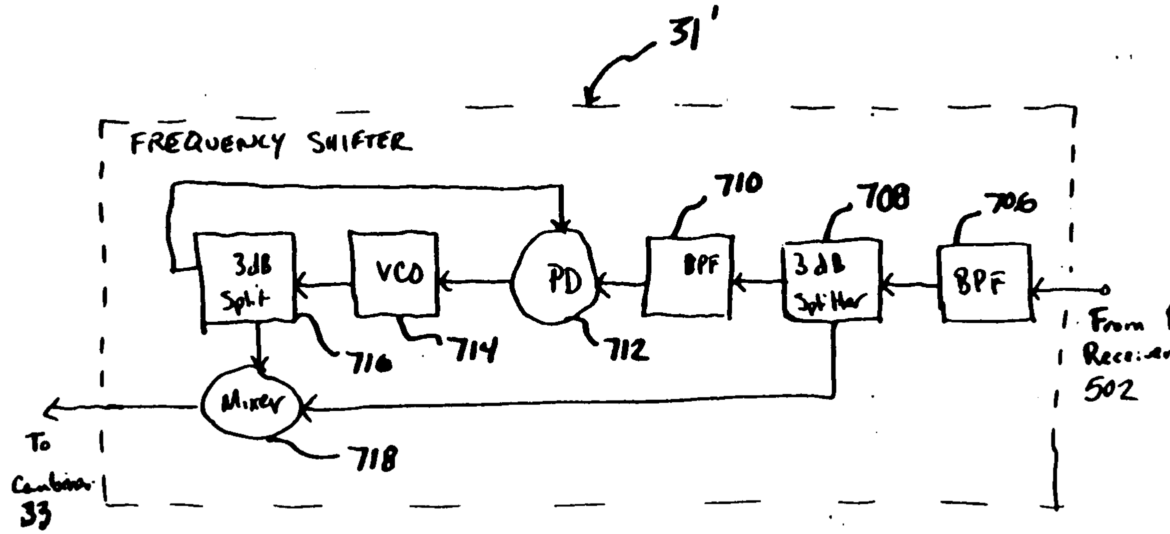

31'
FREQUENCY SHIFTER
3dB Split
VCO
PD
BPF
3dB Splitter
BPF
706
708
710
712
714
716
Mixer
718
From Receiver 502
To Combiner 33

Fig. 6

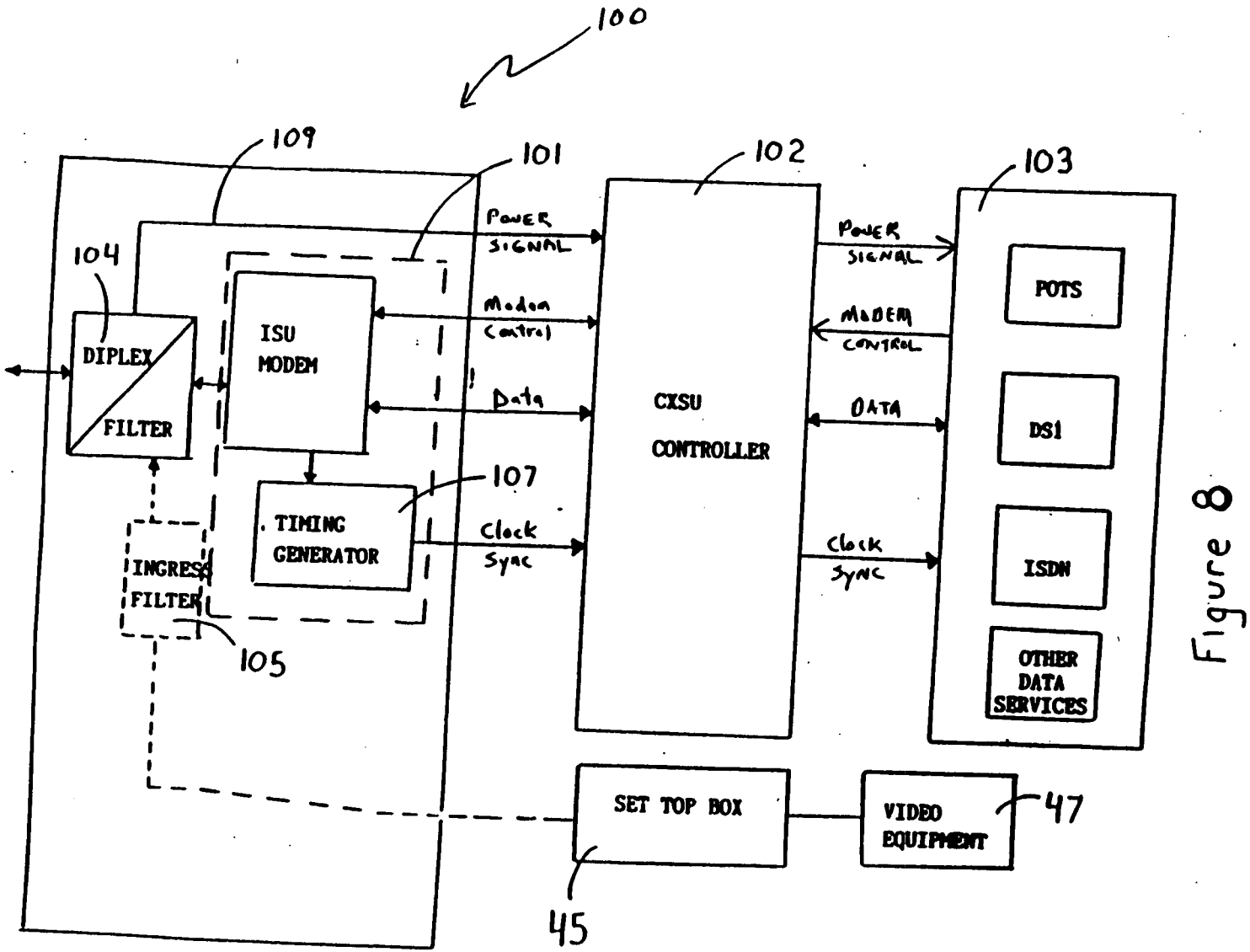


Figure 8

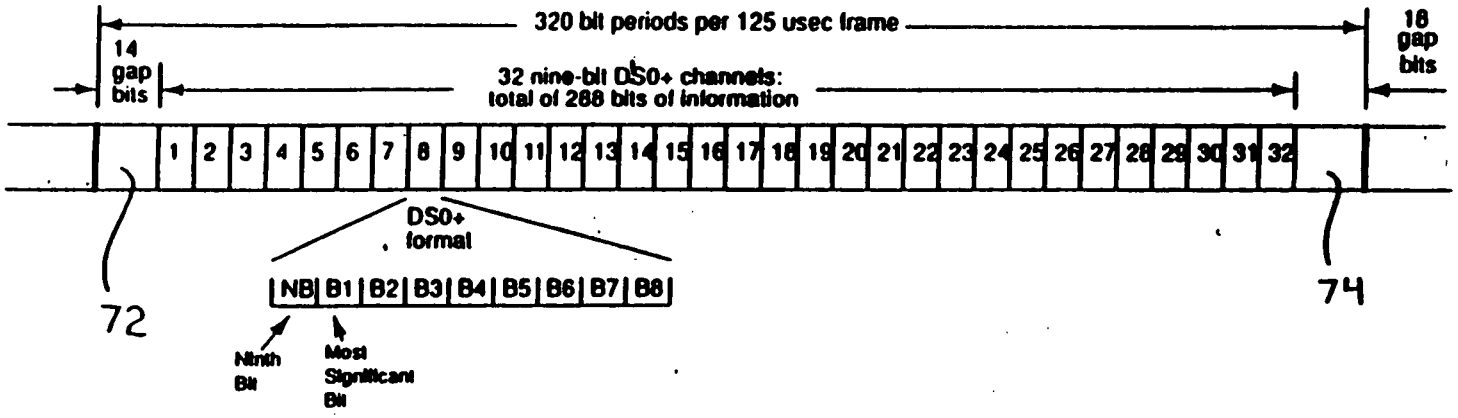


Figure 9

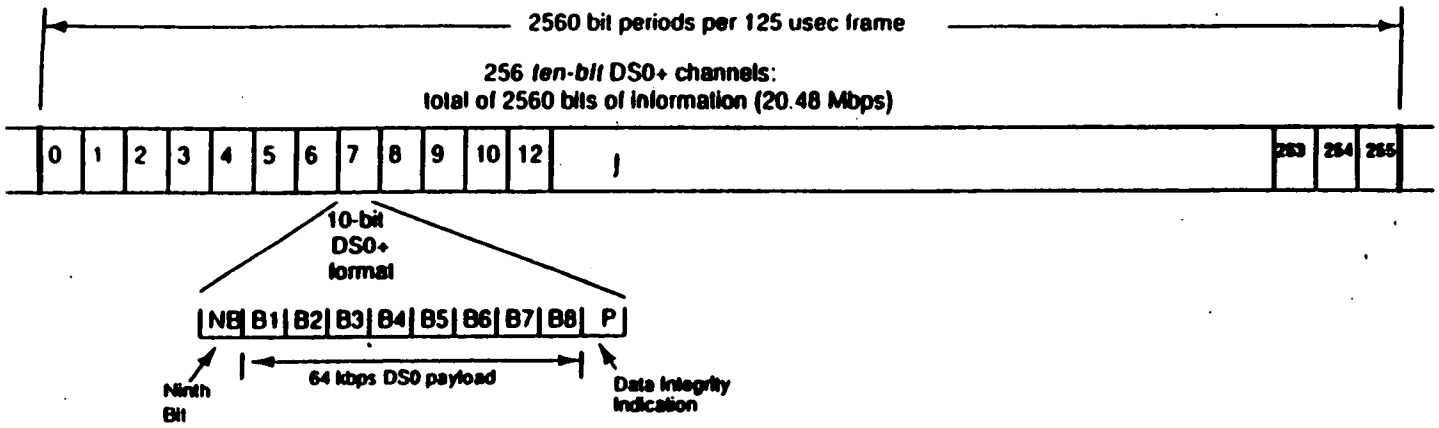


Figure 10.

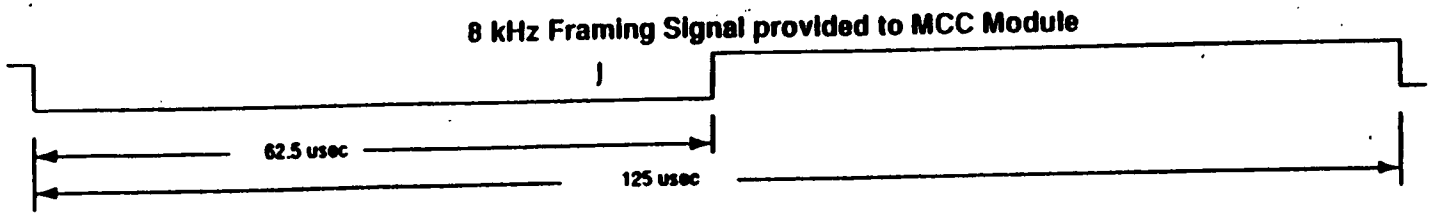


Figure 11

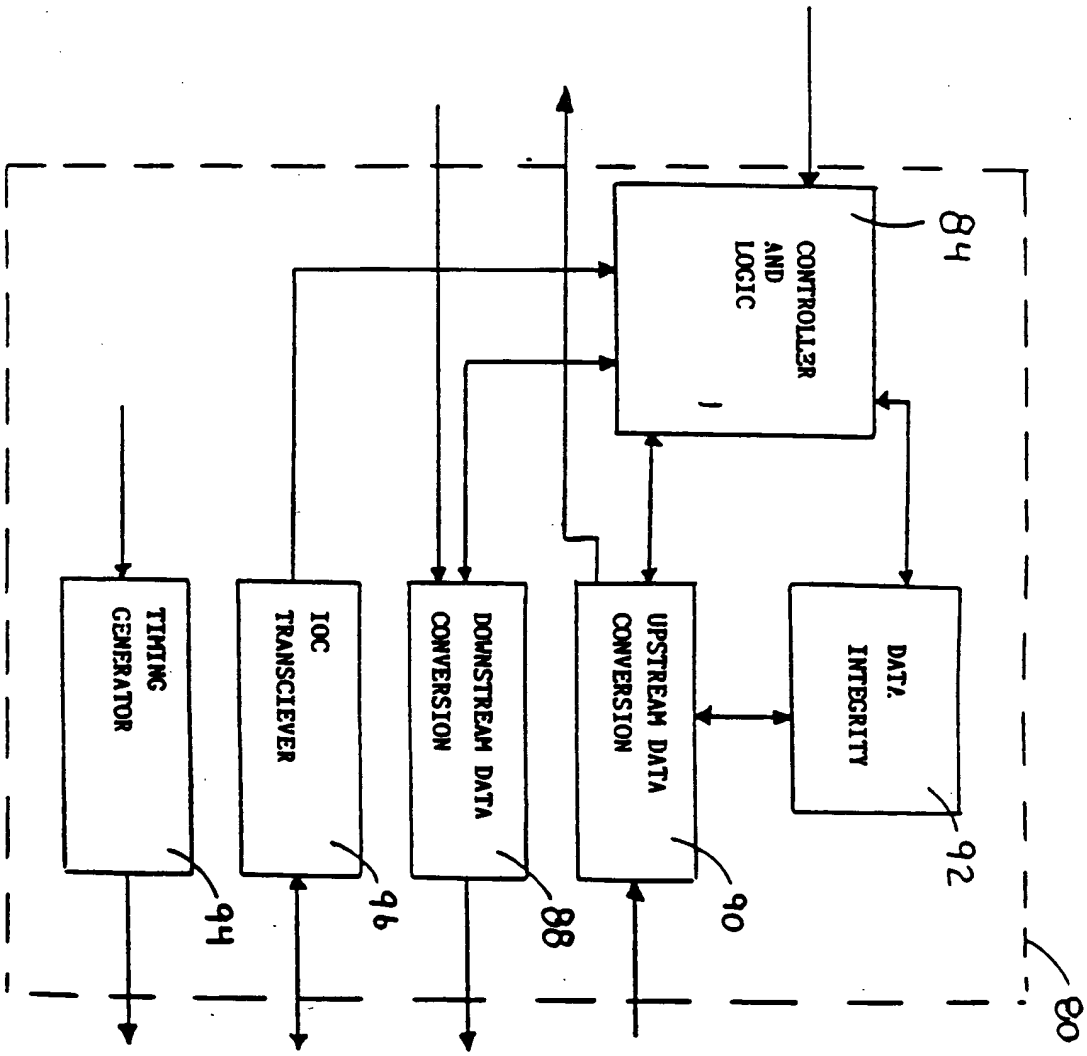


Figure 12

Fig. 13

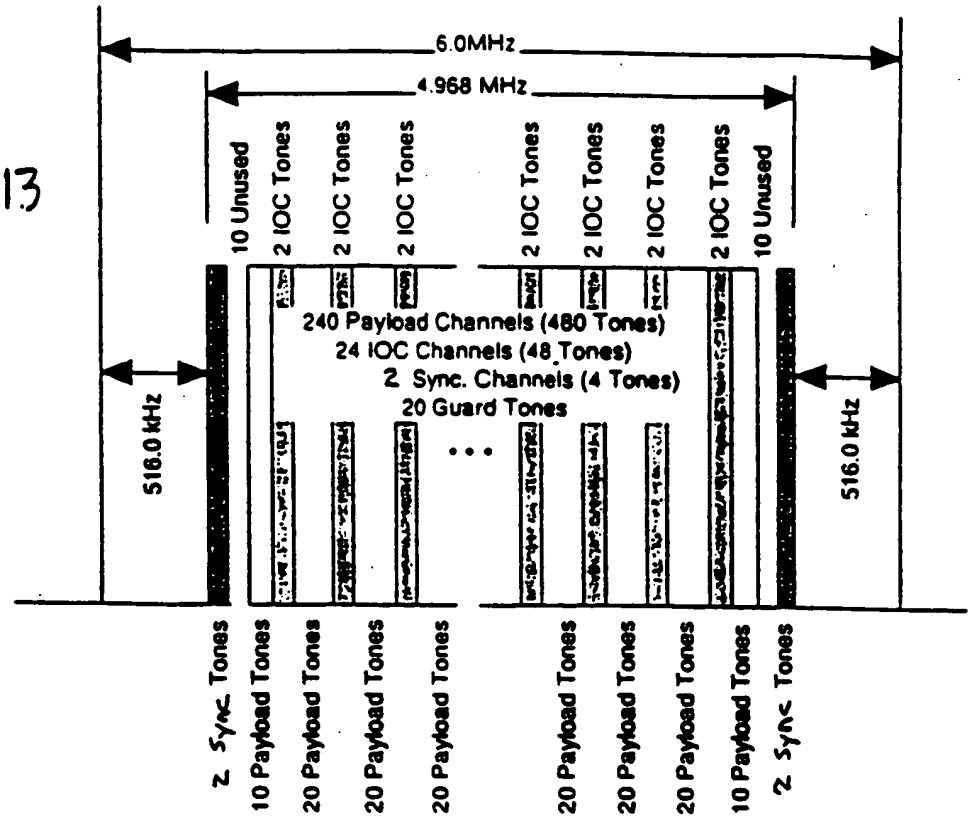
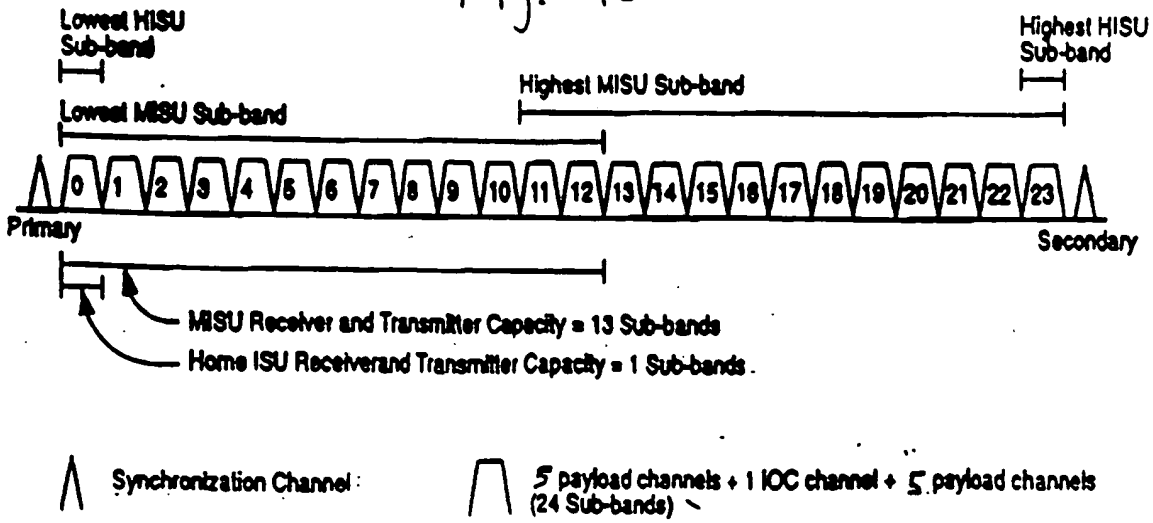

6.0MHz
4.968 MHz
10 Unused
2 IOC Tones
2 IOC Tones
2 IOC Tones
2 IOC Tones
2 IOC Tones
2 IOC Tones
2 IOC Tones
10 Unused
240 Payload Channels (480 Tones)
24 IOC Channels (48 Tones)
2 Sync. Channels (4 Tones)
20 Guard Tones
516.0 kHz
516.0 kHz
2 Sync Tones
10 Payload Tones
20 Payload Tones
20 Payload Tones
20 Payload Tones
20 Payload Tones
20 Payload Tones
20 Payload Tones
10 Payload Tones
2 Sync Tones

Fig. 16


Lowest HISU Sub-band
Highest HISU Sub-band
Highest MISU Sub-band
Lowest MISU Sub-band
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Primary
Secondary
MISU Receiver and Transmitter Capacity = 13 Sub-bands
Home ISU Receiverand Transmitter Capacity = 1 Sub-bands
Synchronization Channel
5 payload channels + 1 IOC channel + 5 payload channels
(24 Sub-bands)

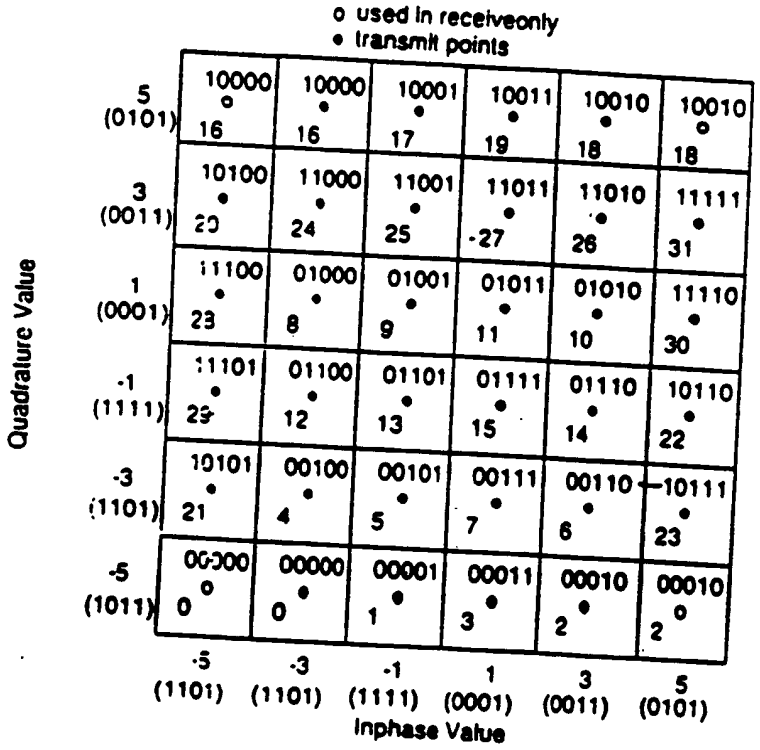


Figure 14

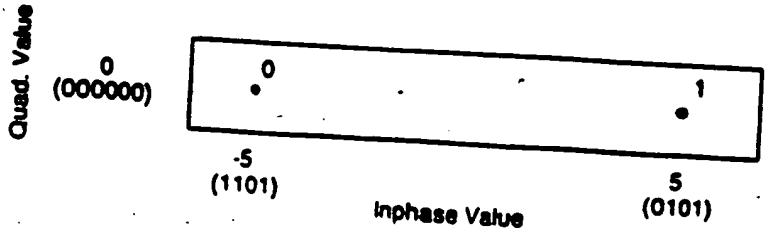


Figure 15

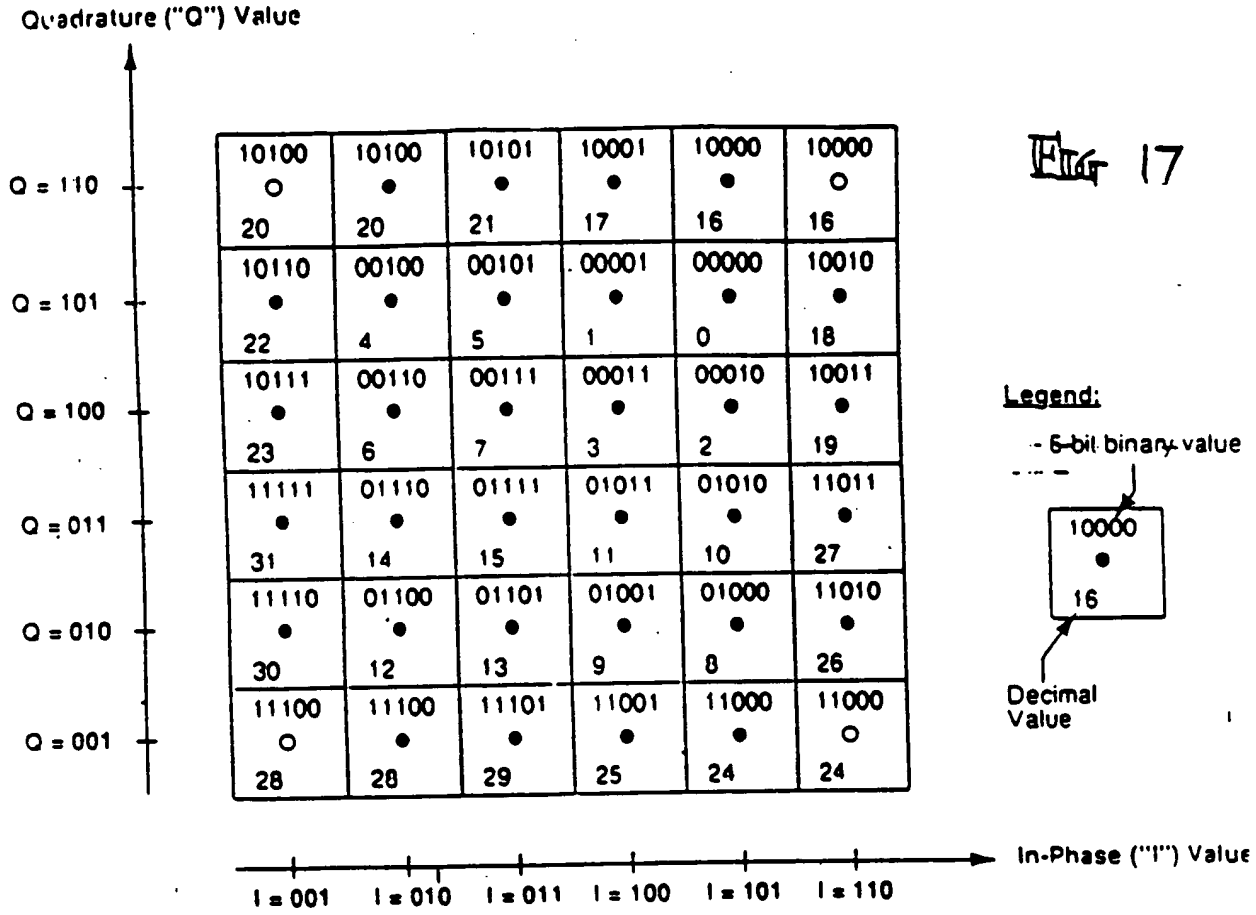

Quadrature ("Q") Value
Q = 110
Q = 101
Q = 100
Q = 011
Q = 010
Q = 001
10100 20 | 10100 20 | 10101 21 | 10001 17 | 10000 16 | 10000 16
10110 22 | 00100 4 | 00101 5 | 00001 1 | 00000 0 | 10010 18
10111 23 | 00110 6 | 00111 7 | 00011 3 | 00010 2 | 10011 19
11111 31 | 01110 14 | 01111 15 | 01011 11 | 01010 10 | 11011 27
11110 30 | 01100 12 | 01101 13 | 01001 9 | 01000 8 | 11010 26
11100 28 | 11100 28 | 11101 29 | 11001 25 | 11000 24 | 11000 24
I = 001
I = 010
I = 011
I = 100
I = 101
I = 110
In-Phase ("I") Value
Legend:
6-bit binary value
10000
16
Decimal Value

Fig 17

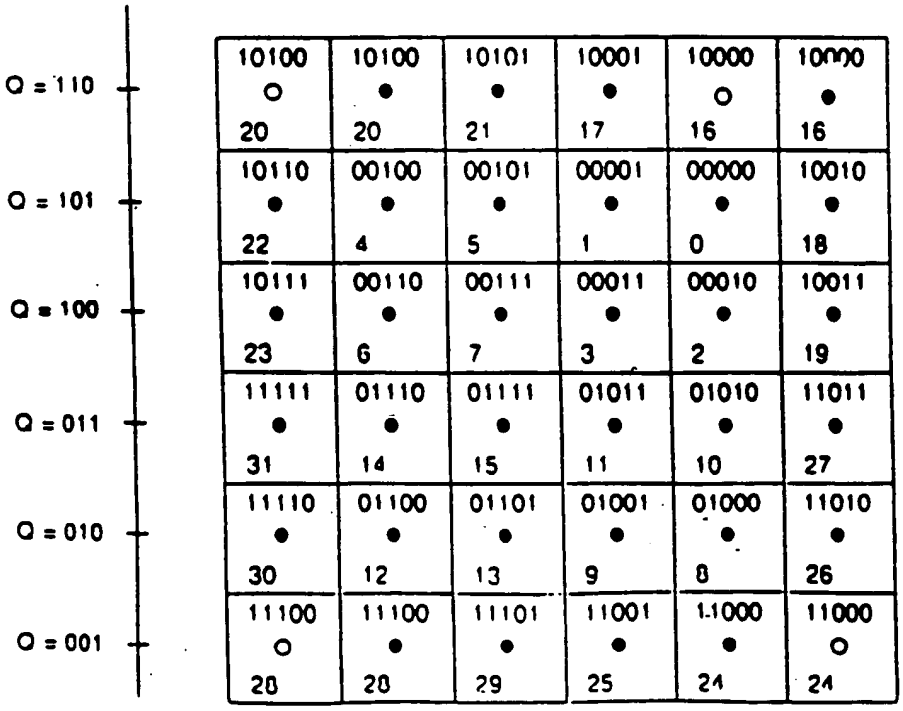

Q = 110
Q = 101
Q = 100
Q = 011
Q = 010
Q = 001
10100 20 | 10100 20 | 10101 21 | 10001 17 | 10000 16 | 10000 16
10110 22 | 00100 4 | 00101 5 | 00001 1 | 00000 0 | 10010 18
10111 23 | 00110 6 | 00111 7 | 00011 3 | 00010 2 | 10011 19
11111 31 | 01110 14 | 01111 15 | 01011 11 | 01010 10 | 11011 27
11110 30 | 01100 12 | 01101 13 | 01001 9 | 01000 8 | 11010 26
11100 28 | 11100 28 | 11101 29 | 11001 25 | 11000 24 | 11000 24

Fig 18

Figure 19

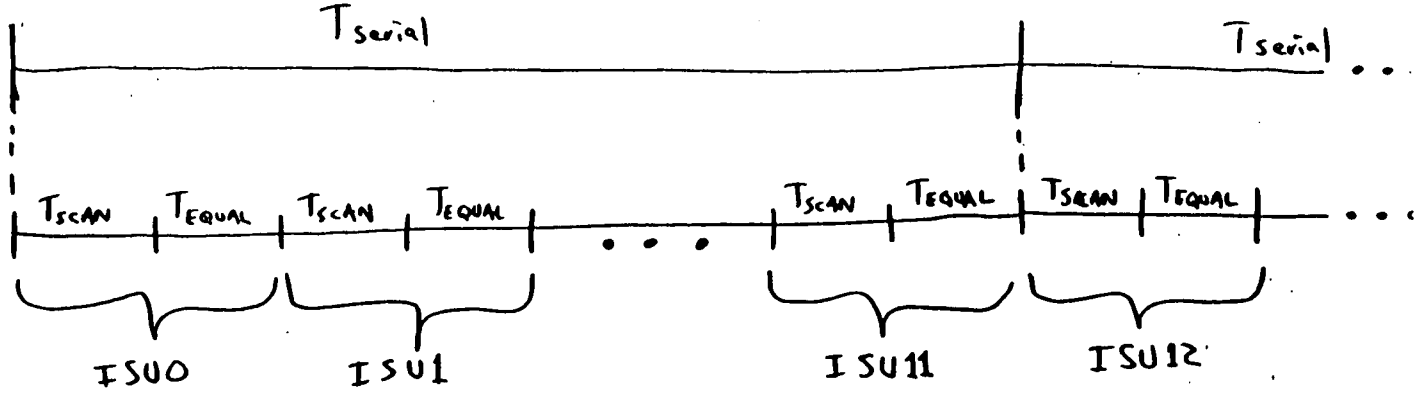
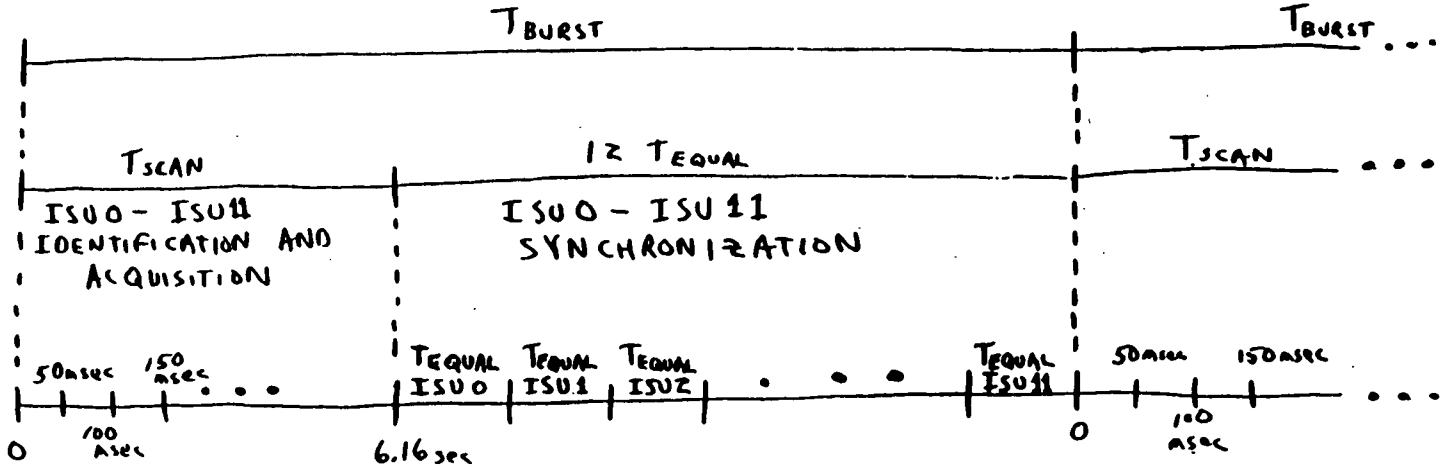


Figure 20



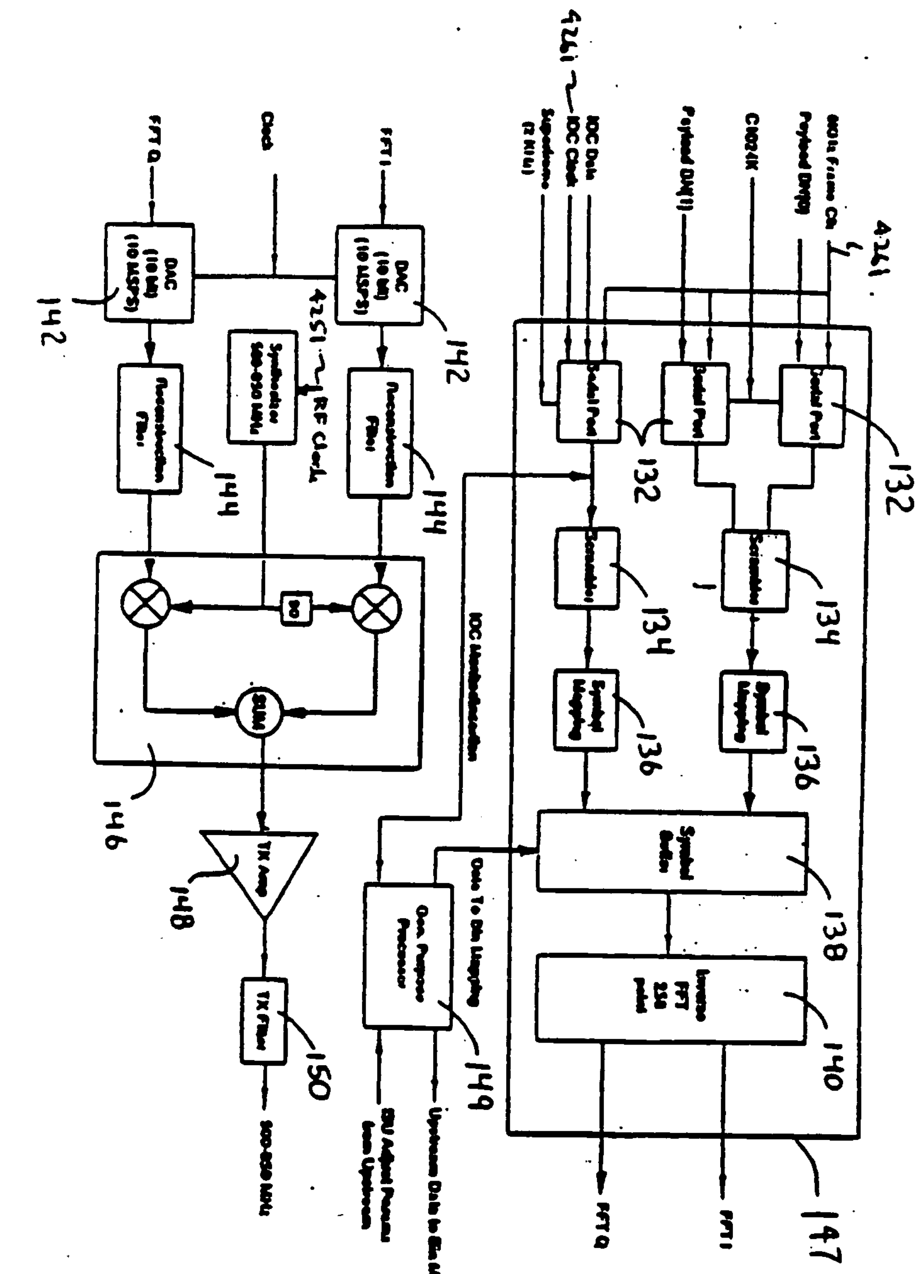

132
132
134
134
136
136
138
140
142
142
144
144
146
147
148
149
150

Figure 21

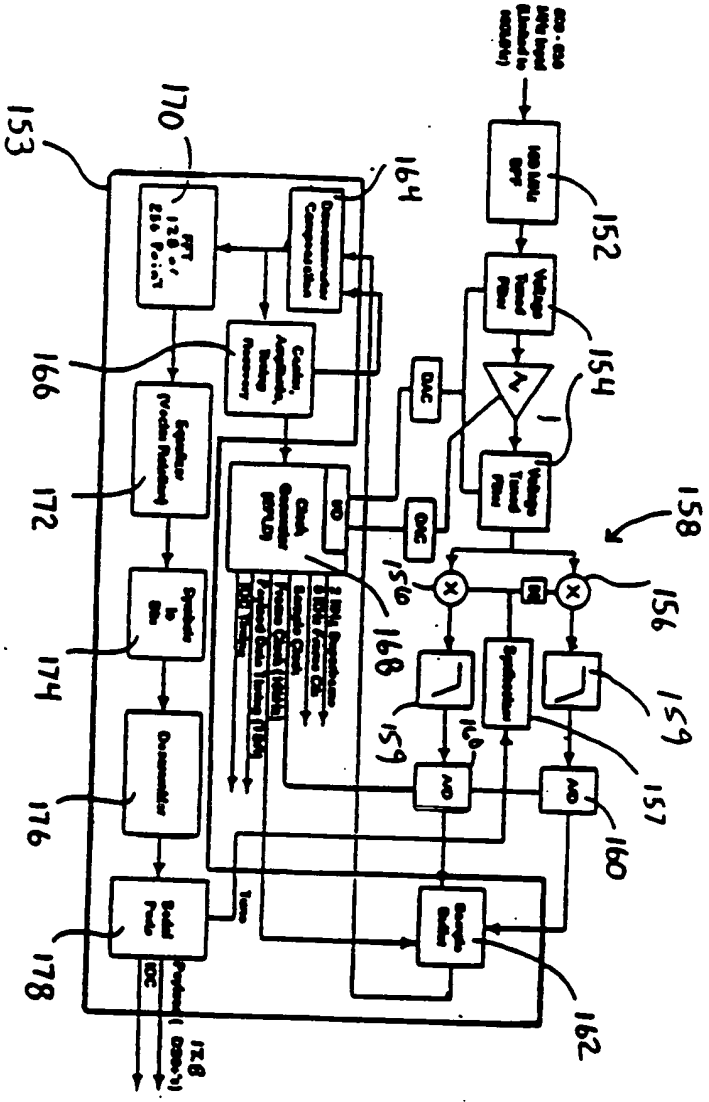

153
170
164
152
166
154
172
158
168
156
174
159
157
176
160
178
162

Figure 22

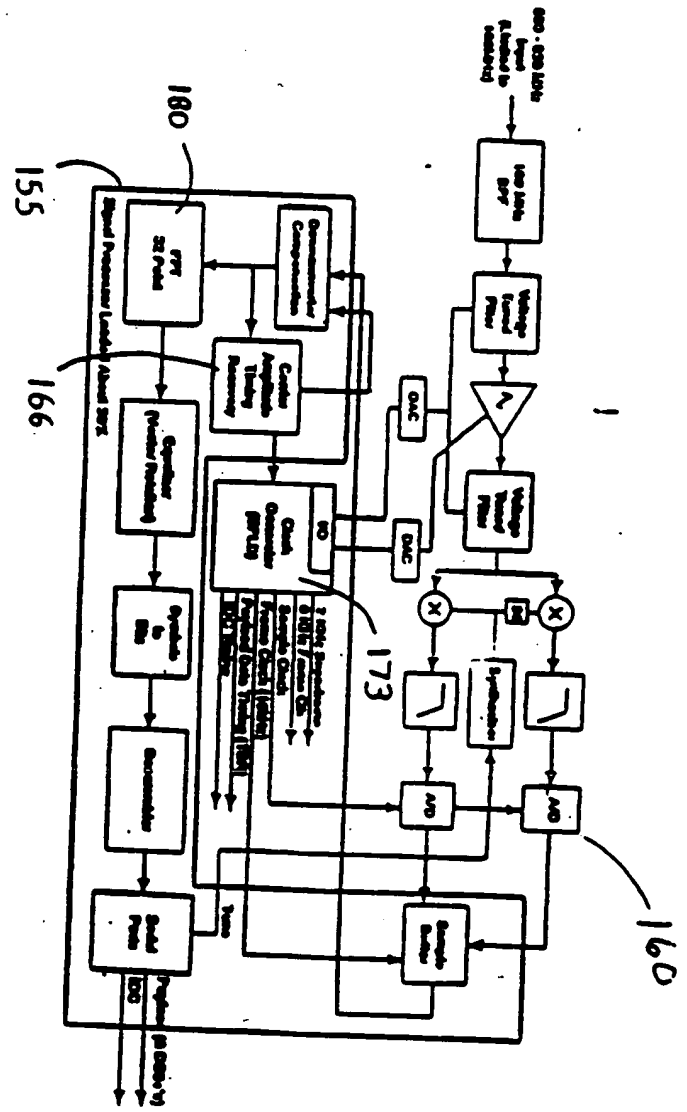


Figure 23

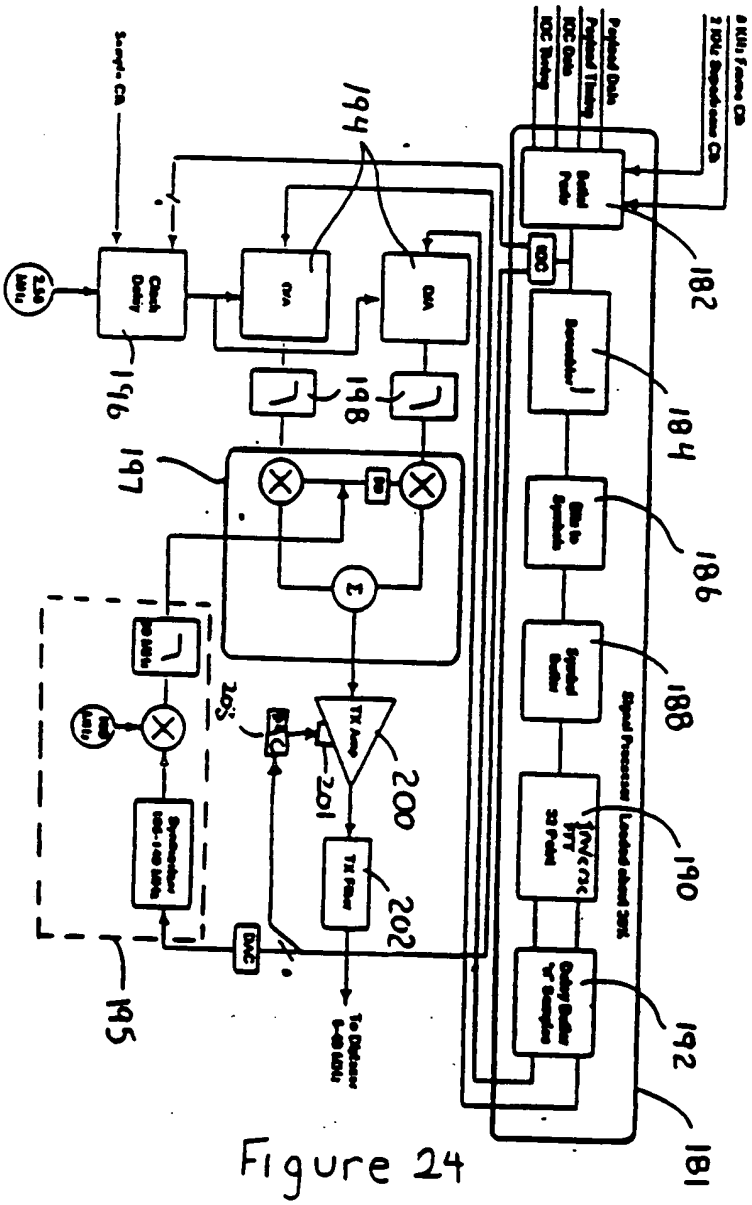


Figure 24

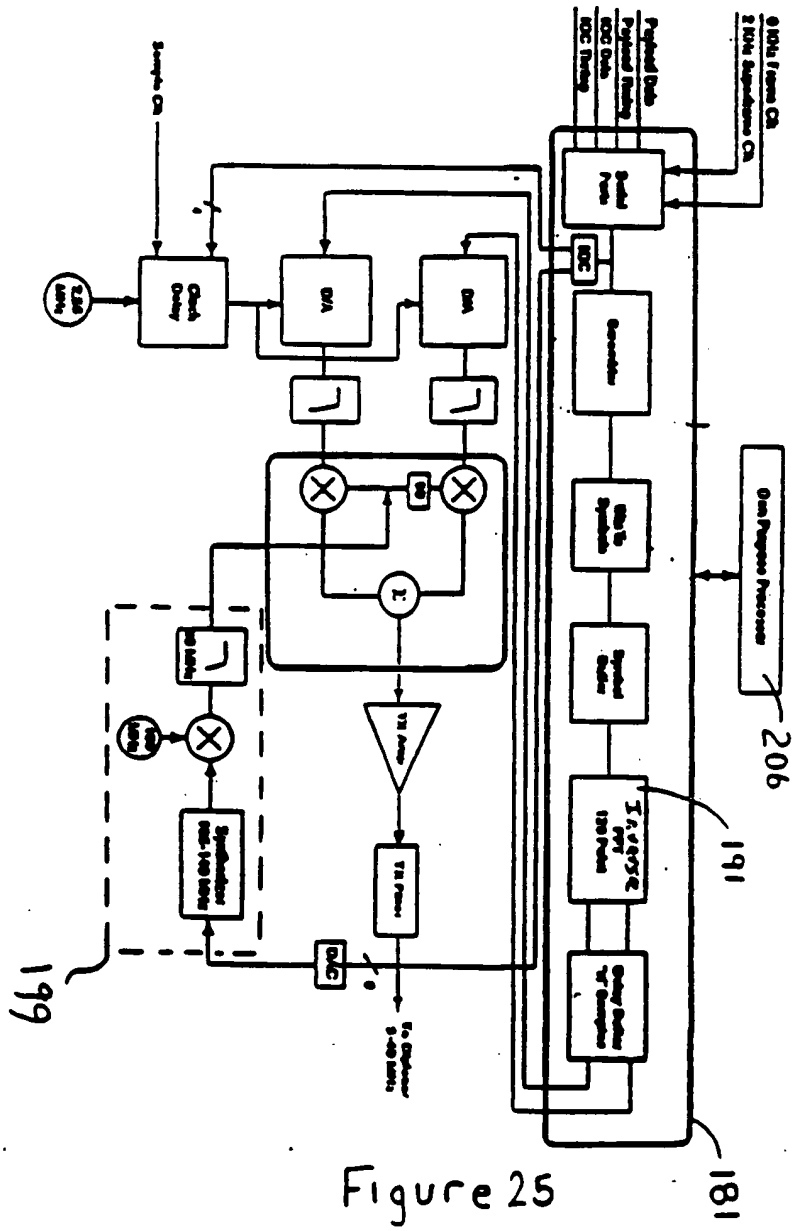


Figure 25

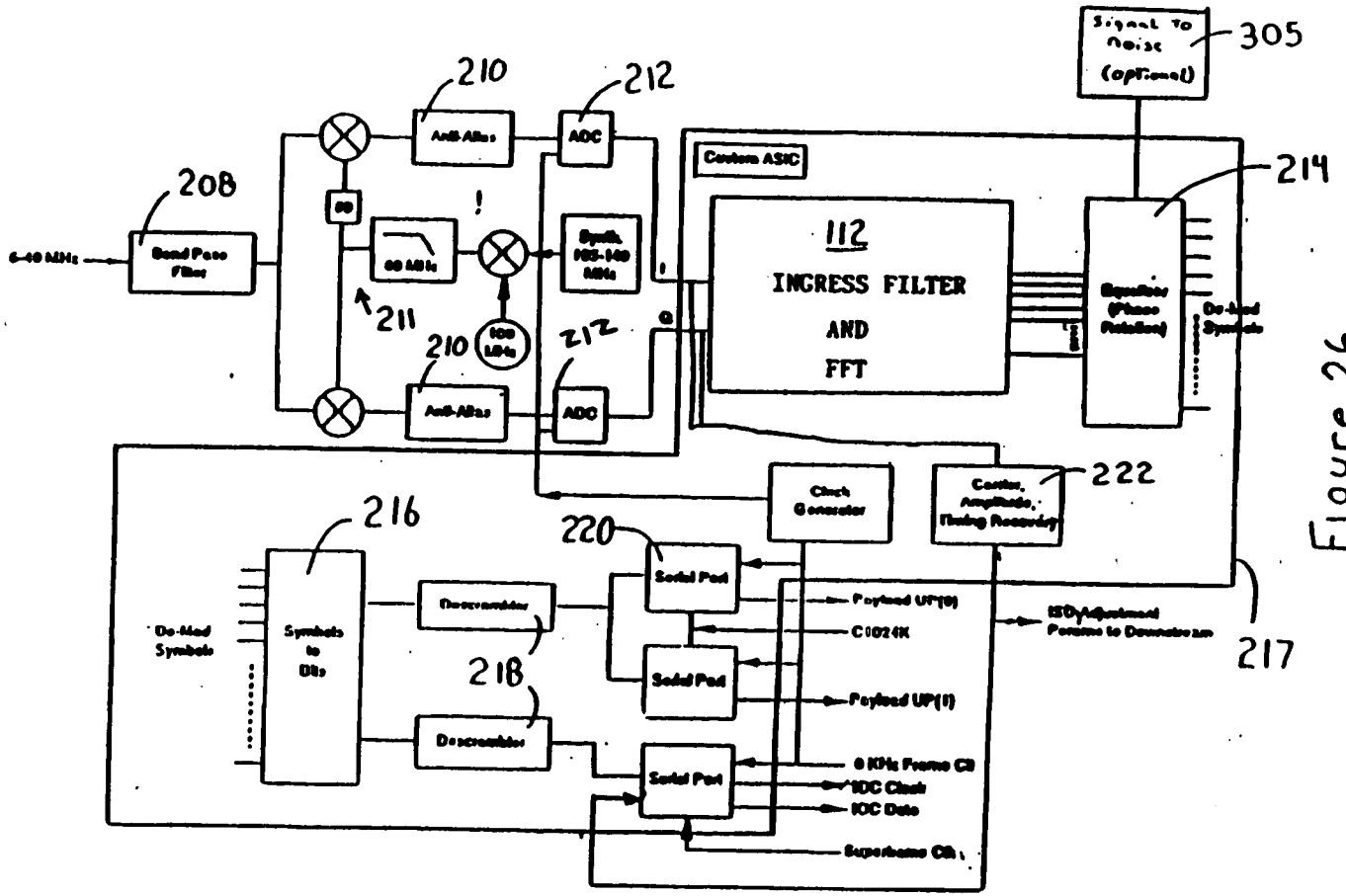

305
210
212
208
214
112
INGRESS FILTER
AND
FFT
211
210
212
216
220
222
217
218

Figure 26

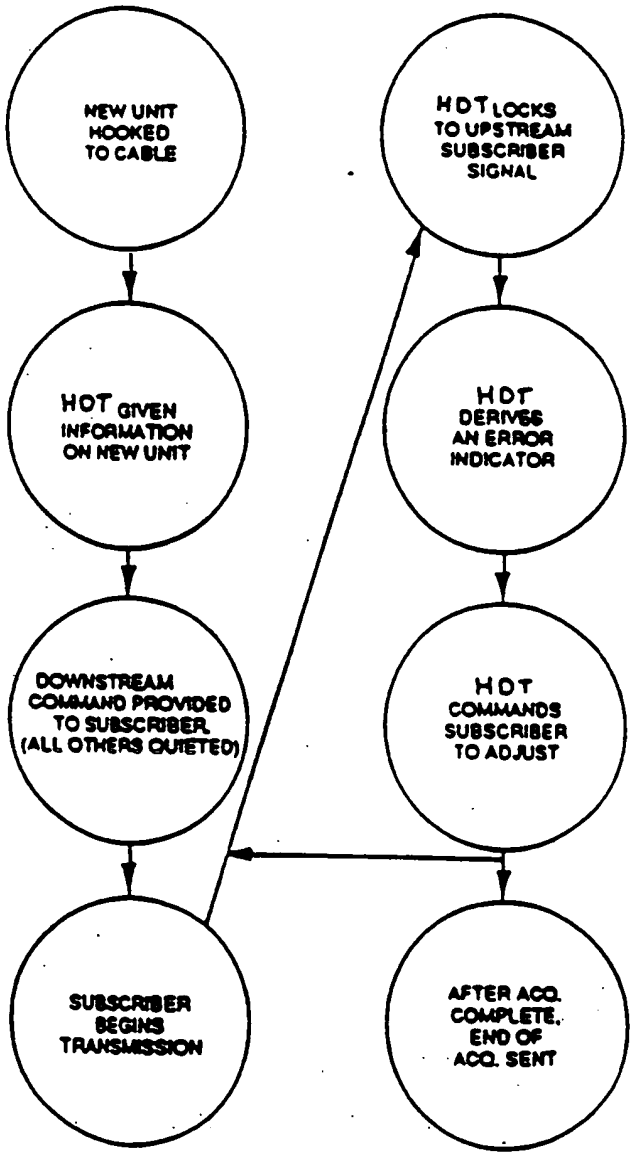

NEW UNIT HOOKED TO CABLE
HDT GIVEN INFORMATION ON NEW UNIT
DOWNSTREAM COMMAND PROVIDED TO SUBSCRIBER (ALL OTHERS QUIETED)
SUBSCRIBER BEGINS TRANSMISSION
HDT LOCKS TO UPSTREAM SUBSCRIBER SIGNAL
HDT DERIVES AN ERROR INDICATOR
HDT COMMANDS SUBSCRIBER TO ADJUST
AFTER ACQ. COMPLETE, END OF ACQ. SENT

Figure 27

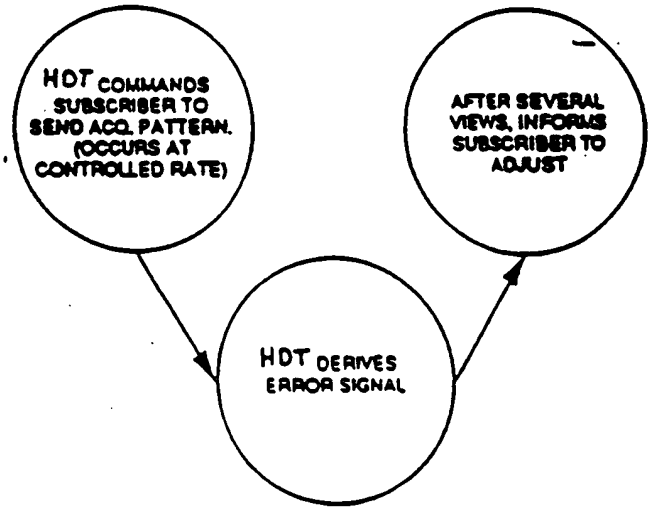

HDT COMMANDS SUBSCRIBER TO SEND ACQ. PATTERN. (OCCURS AT CONTROLLED RATE)
AFTER SEVERAL VIEWS, INFORMS SUBSCRIBER TO ADJUST
HDT DERIVES ERROR SIGNAL

Figure 28

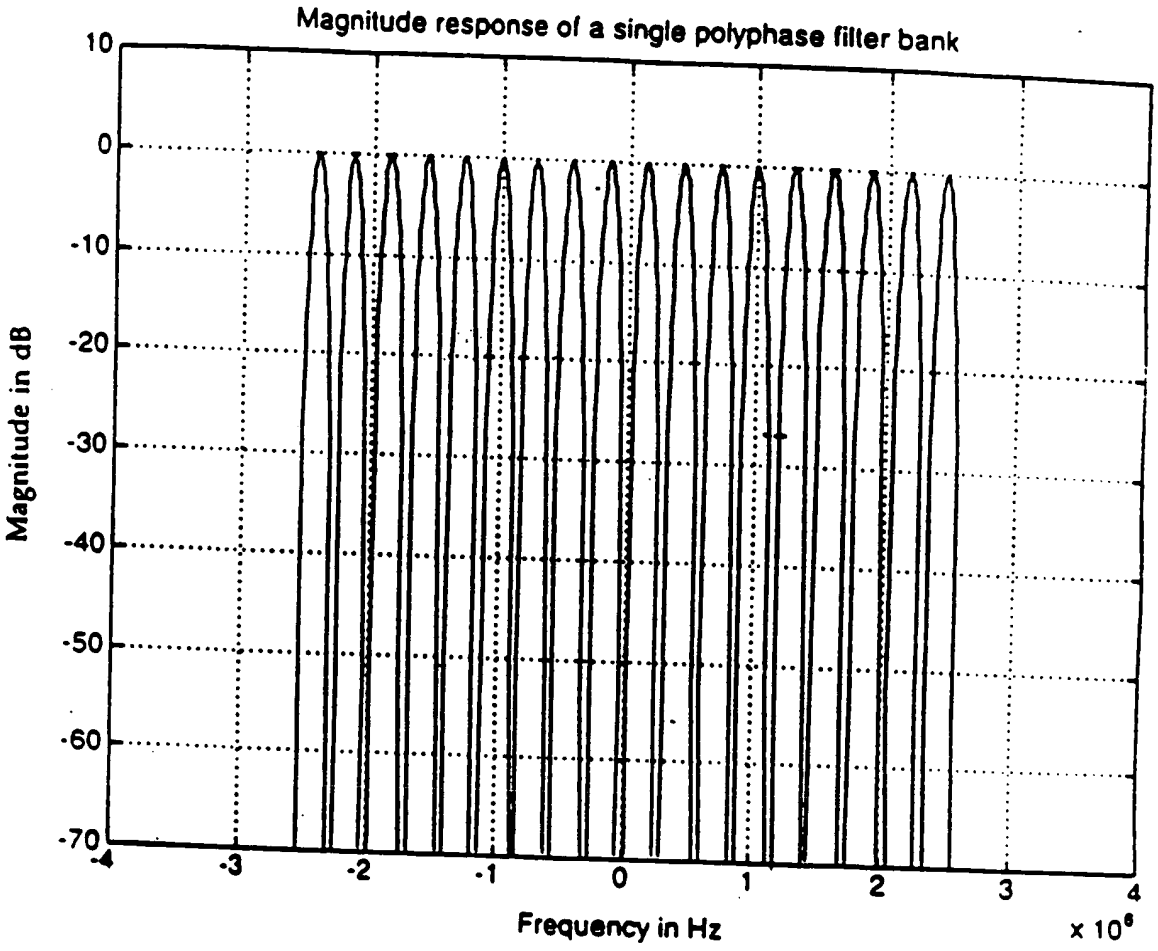

Magnitude response of a single polyphase filter bank
Magnitude in dB
10
0
-10
-20
-30
-40
-50
-60
-70
-4
-3
-2
-1
0
1
2
3
4
Frequency in Hz
x 10^6

Figure 29

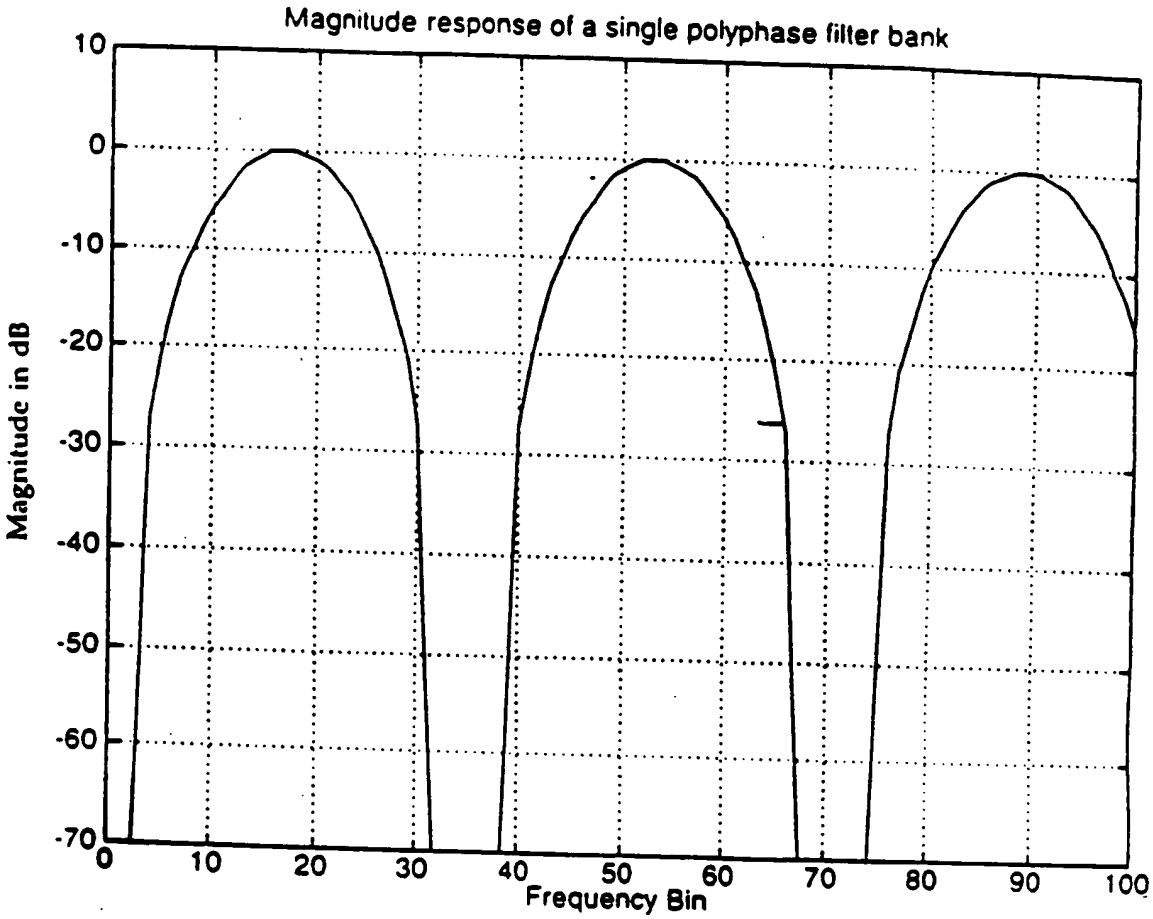

Magnitude response of a single polyphase filter bank
Magnitude in dB
10
0
-10
-20
-30
-40
-50
-60
-70
0
10
20
30
40
50
60
70
80
90
100
Frequency Bin

Figure 30

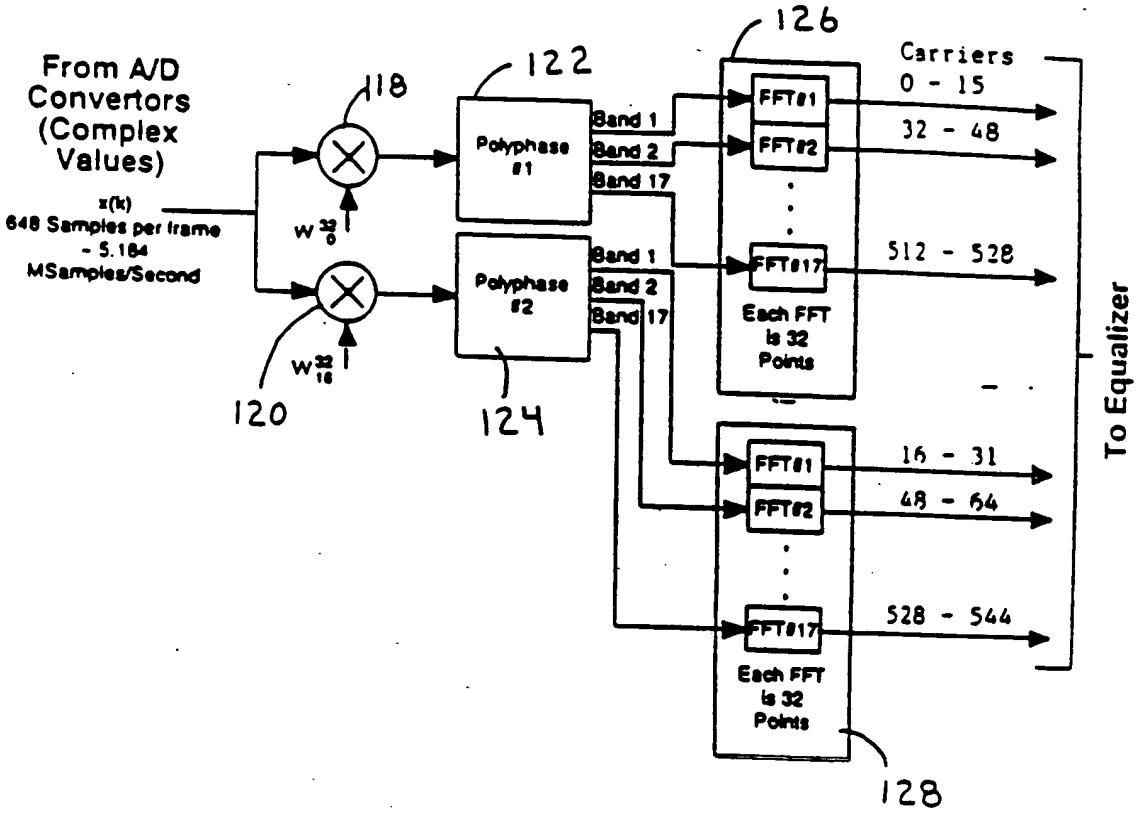


Figure 31

112

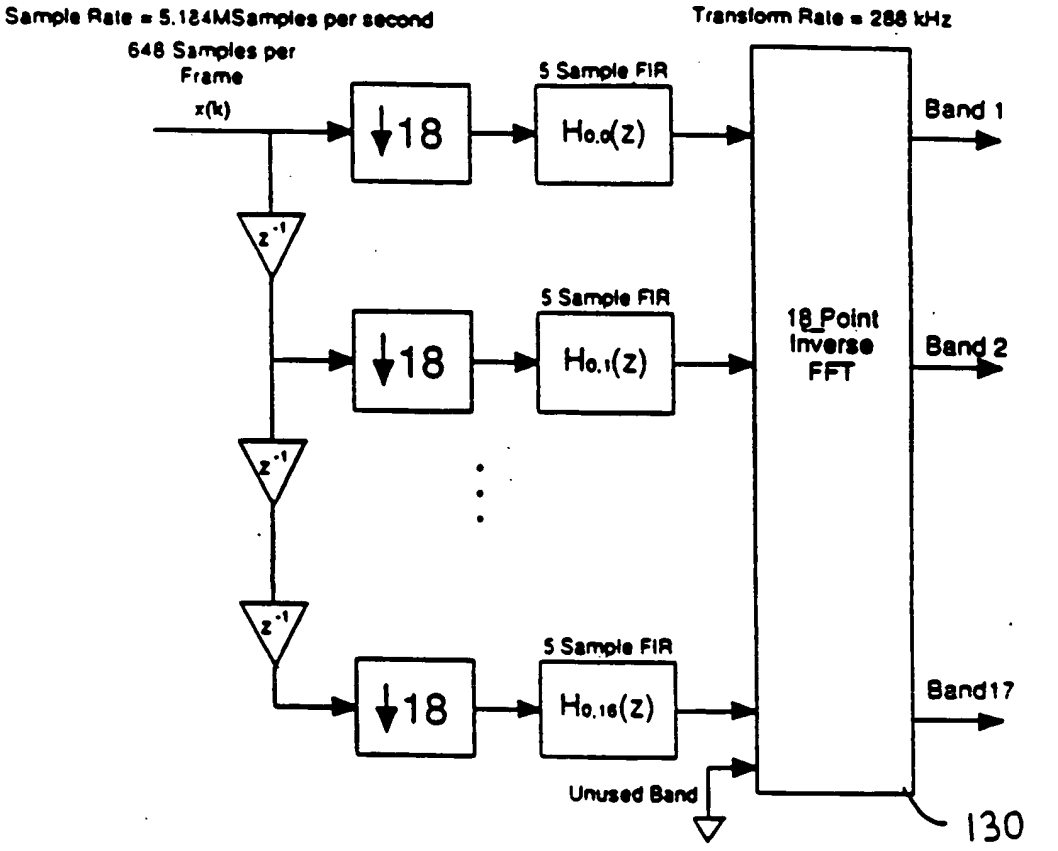

Sample Rate = 5.184MSamples per second
Transform Rate = 288 kHz
648 Samples per Frame
x(k)
5 Sample FIR
↓18
H0,0(Z)
Band 1
z-1
5 Sample FIR
↓18
H0,1(Z)
18 Point Inverse FFT
Band 2
z-1
z-1
5 Sample FIR
↓18
H0,16(Z)
Band17
Unused Band
130
122, 124

Figure 32

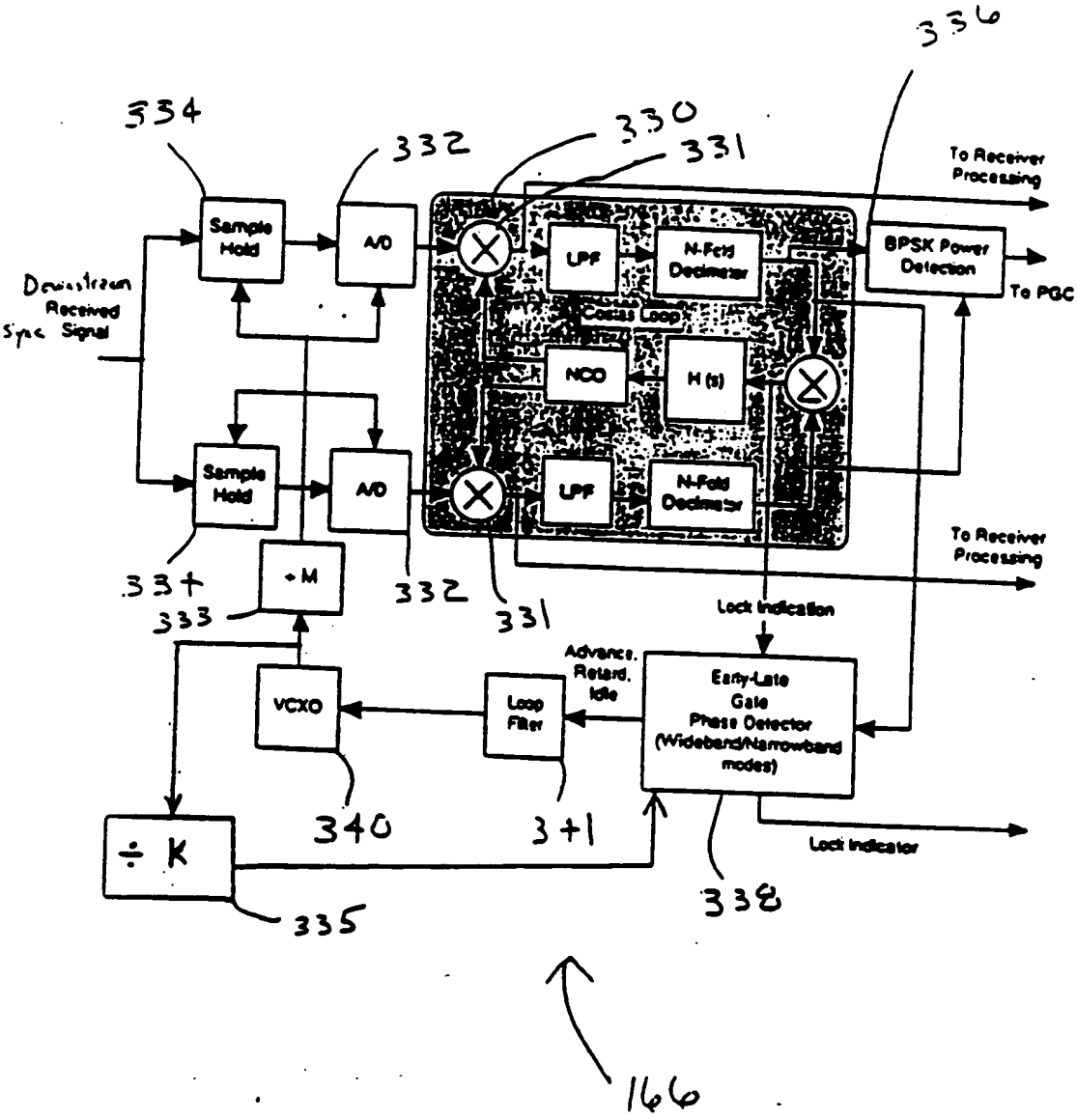

334
332
330
331
336
To Receiver Processing
Sample Hold
A/D
LPF
N-Fold Decimator
BPSK Power Detection
To PGC
Downstream Received Sync Signal
Costas Loop
NCO
H (s)
Sample Hold
A/D
LPF
N-Fold Decimator
To Receiver Processing
334
÷M
333
332
331
Lock Indication
Advance, Retard, Idle
VCXO
Loop Filter
Early-Late Gate Phase Detector (Wideband/Narrowband modes)
340
341
÷ K
335
338
Lock Indicator
166

Figure 33

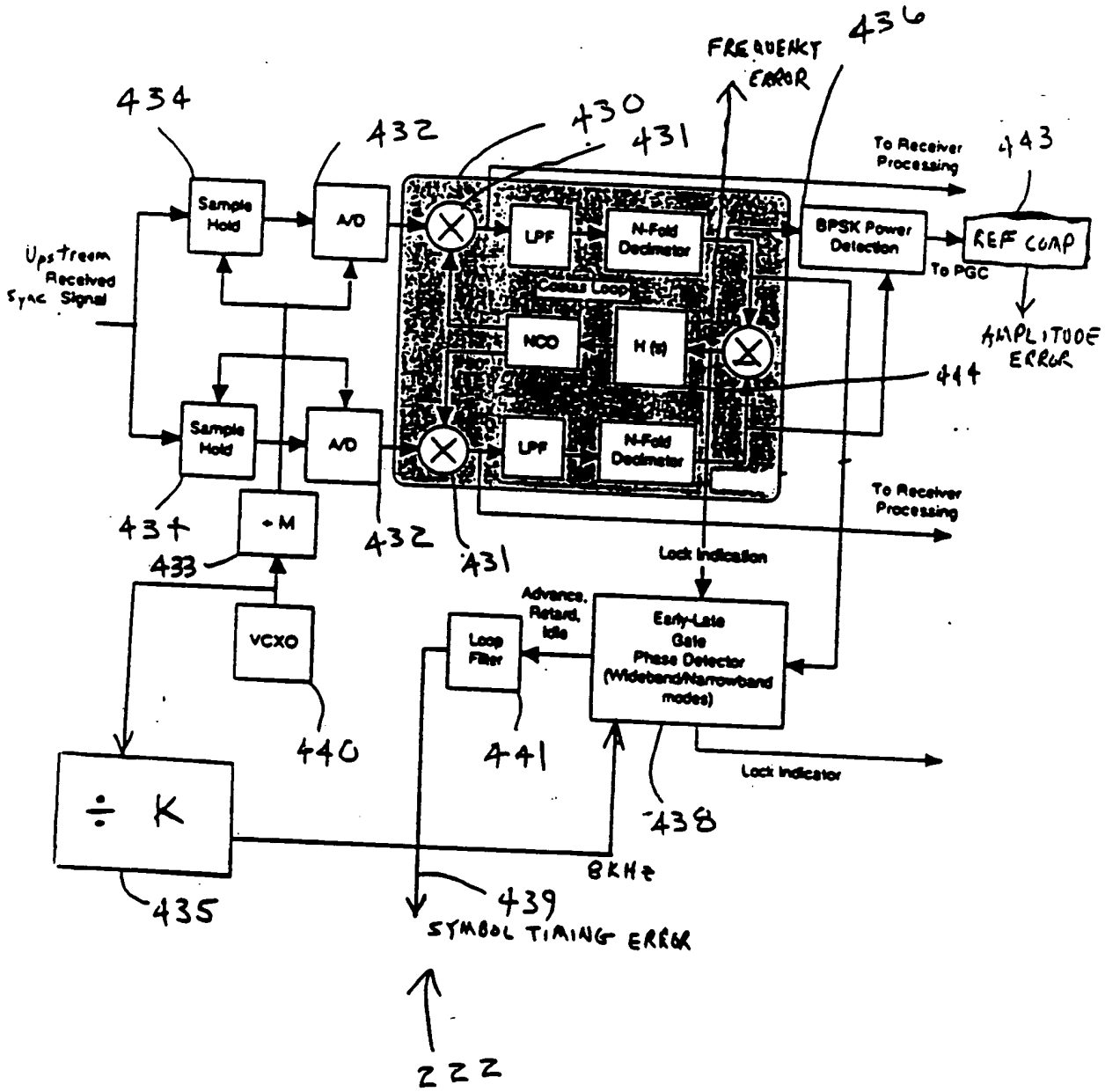
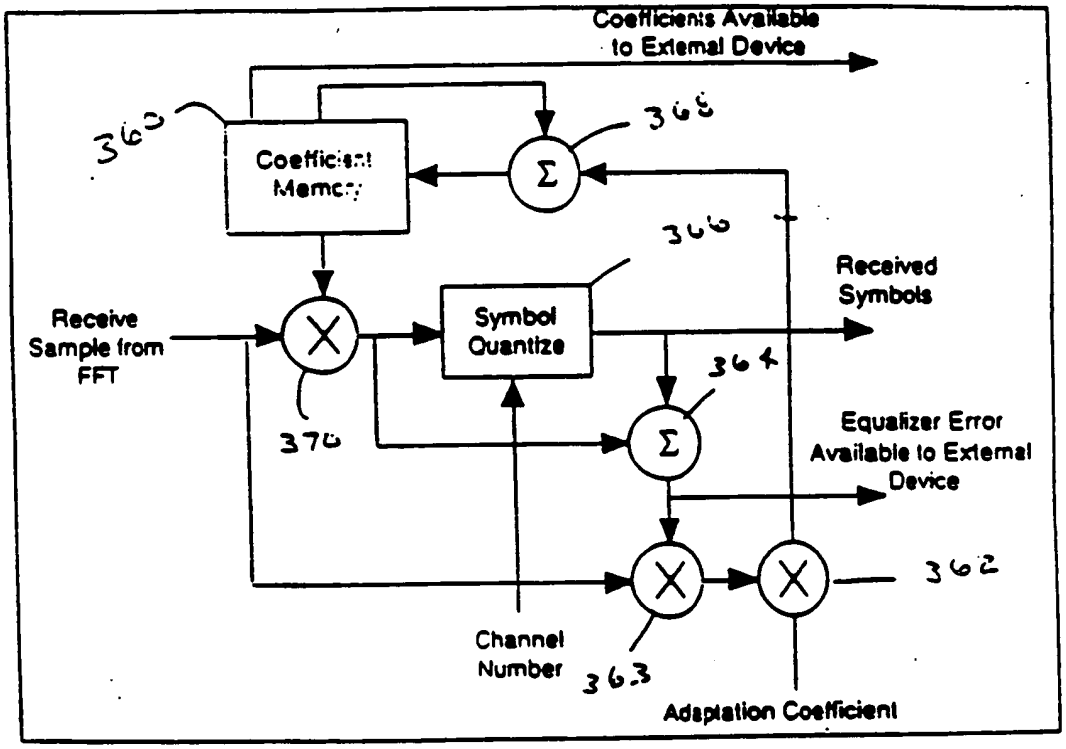

436
FREQUENCY ERROR
434
432
430
431
To Receiver Processing
443
Sample Hold
A/D
LPF
N-Fold Decimator
BPSK Power Detection
REF COMP
To PGC
Upstream Received Sync Signal
Costas Loop
NCO
H(s)
AMPLITUDE ERROR
444
Sample Hold
A/D
LPF
N-Fold Decimator
To Receiver Processing
434
÷M
433
432
431
Lock Indication
Advance, Retard, Idle
Early-Late Gate Phase Detector (Wideband/Narrowband modes)
VCXO
Loop Filter
440
441
Lock Indicator
438
÷ K
8KHz
435
439
SYMBOL TIMING ERROR
ZZZ

Figure 34



172, 214

Figure 35

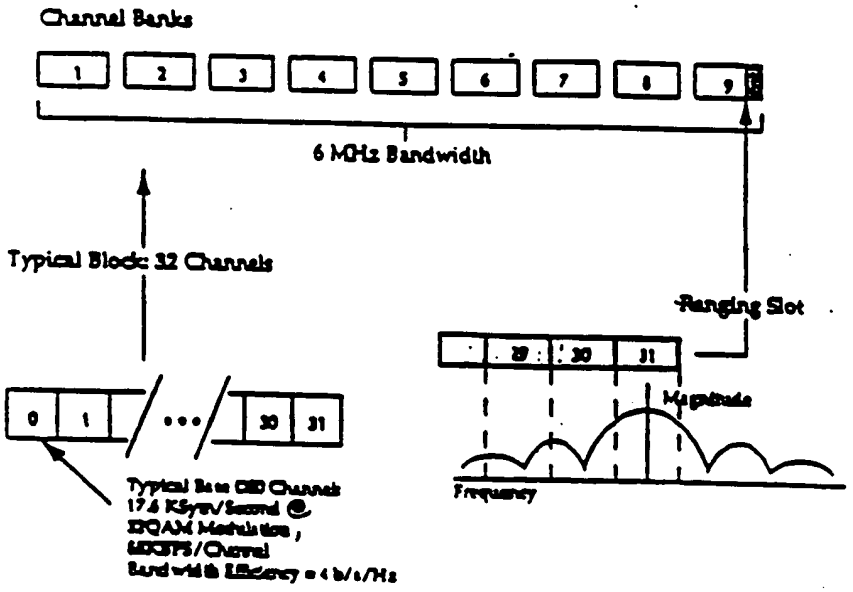

Channel Banks
1
2
3
4
5
6
7
8
9
6 MHz Bandwidth
Typical Block 32 Channels
Ranging Slot
30
31
Magnitude
Frequency
0
1
30
31

Figure 36

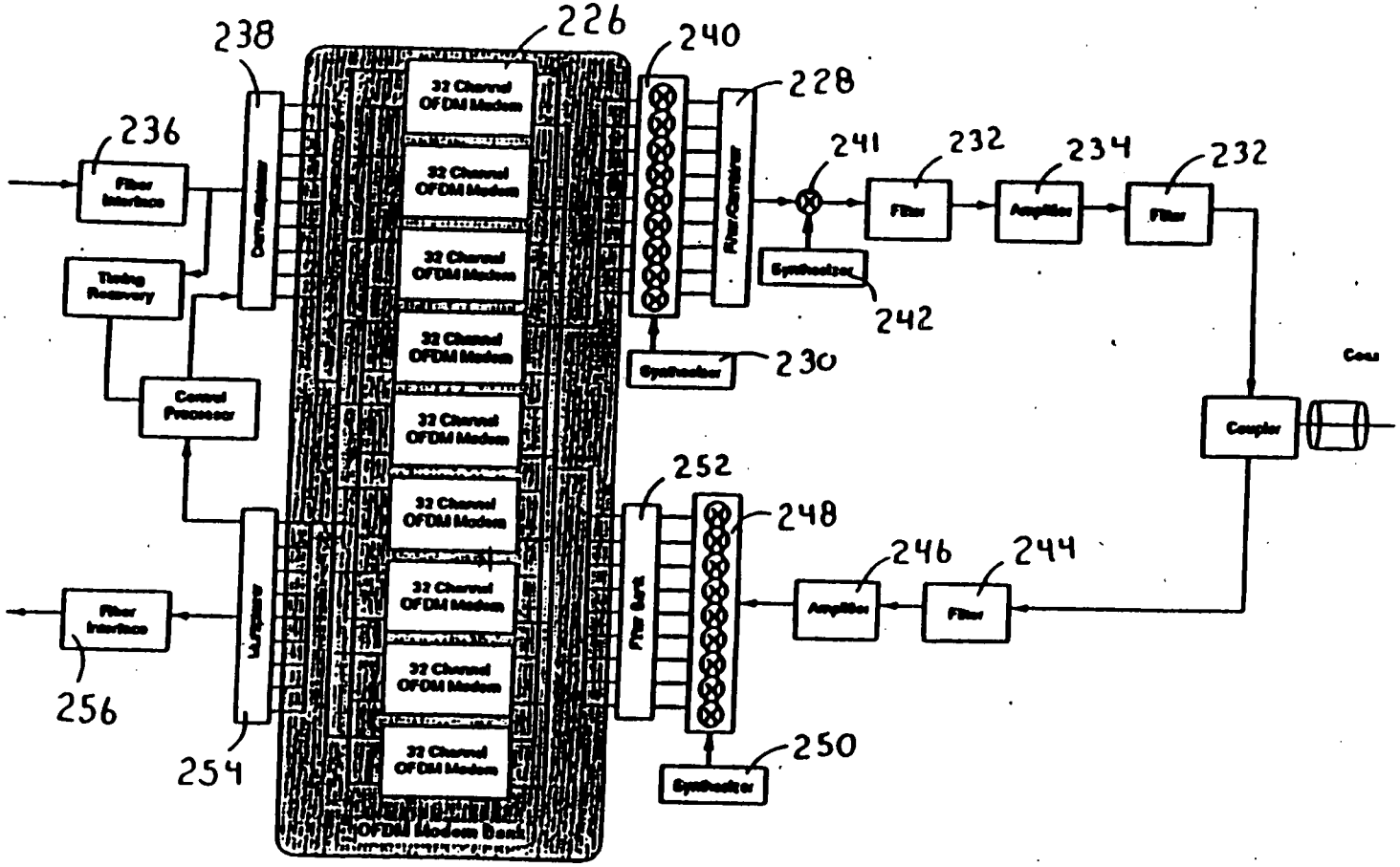

238
226
240
228
236
241
232
234
232
242
230
252
248
246
244
256
254
250
32 Channel OFDM Modem
OFDM Modem Bank
Coupler

Figure 37

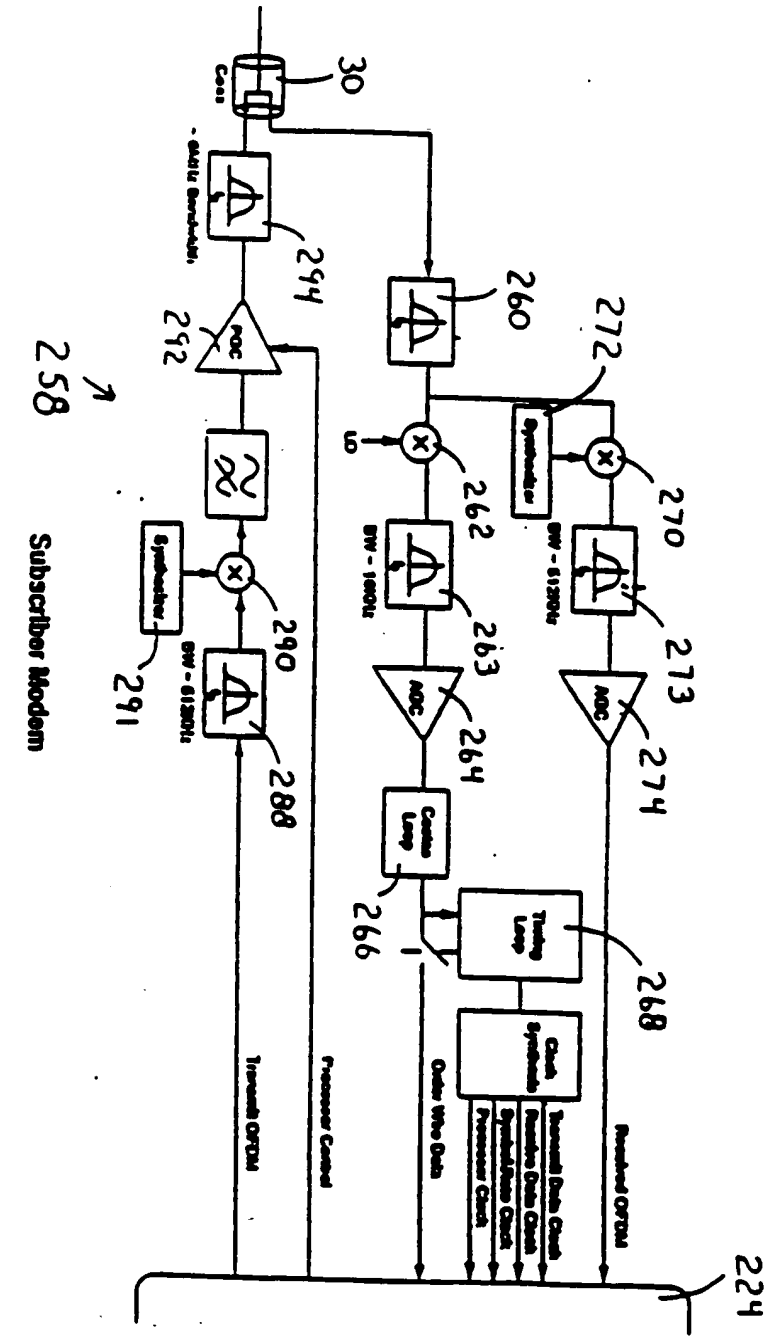


Figure 38

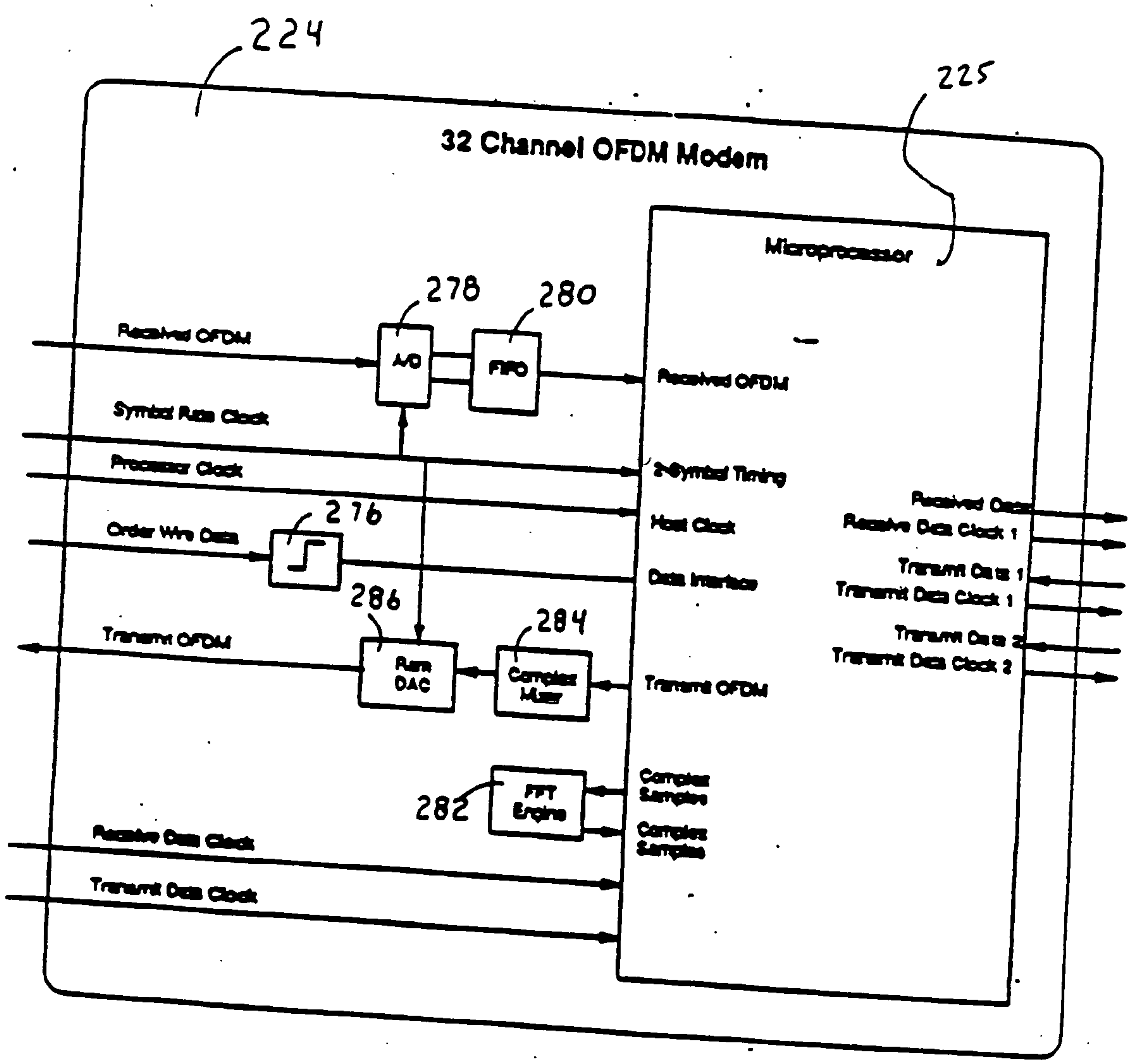

224
225
32 Channel OFDM Modem
Microprocessor
278
280
Received OFDM
A/D
FIFO
Received OFDM
Symbol Rate Clock
Processor Clock
2-Symbol Timing
Host Clock
276
Order Wire Data
Data Interface
286
284
Transmit OFDM
DAC
Complex Mixer
Transmit OFDM
282
FFT Engine
Complex Samples
Complex Samples
Receive Data Clock
Transmit Data Clock
Received Data
Receive Data Clock 1
Transmit Data 1
Transmit Data Clock 1
Transmit Data 2
Transmit Data Clock 2

Figure 39

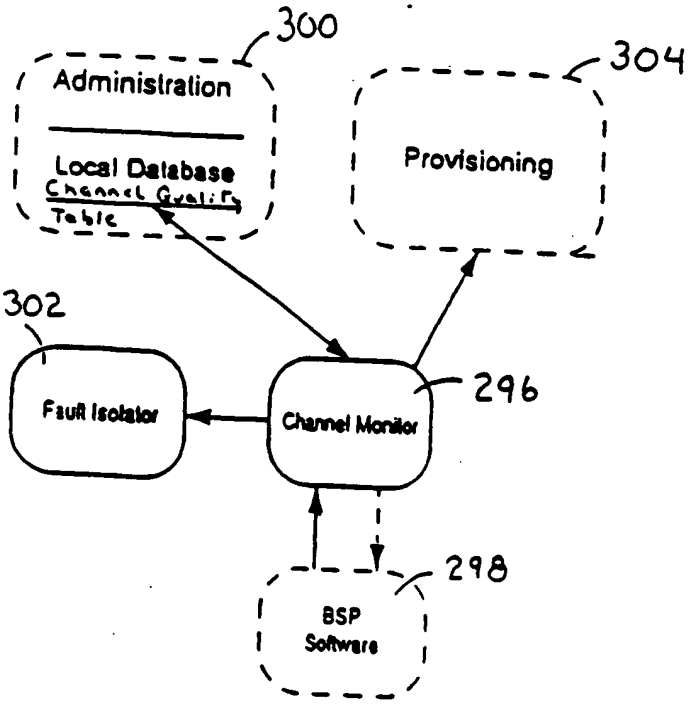

300
Administration
Local Database
Channel Quality
Table
304
Provisioning
302
Fault Isolator
Channel Monitor
296
298
BSP
Software

Figure 40

Figure 41

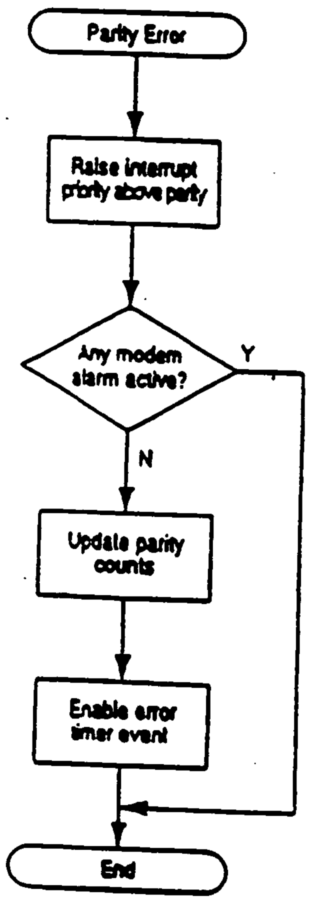
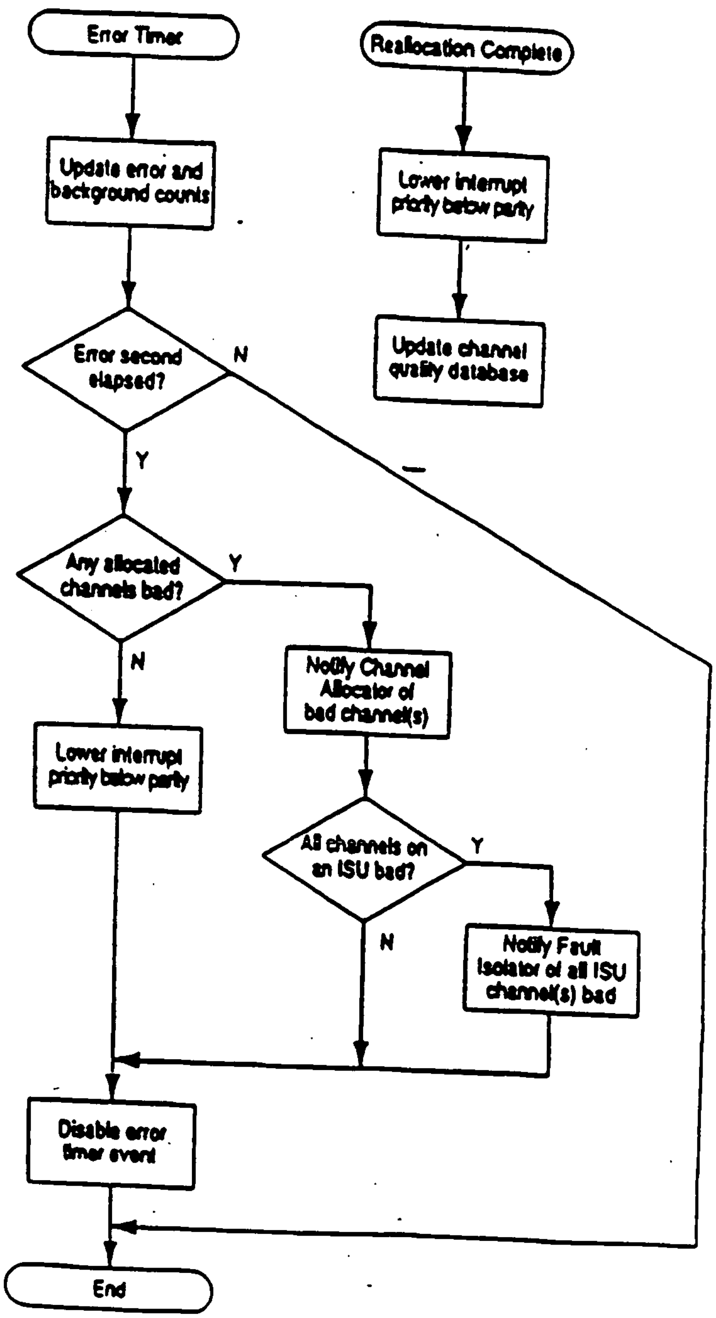


Figure 42

Figure 43



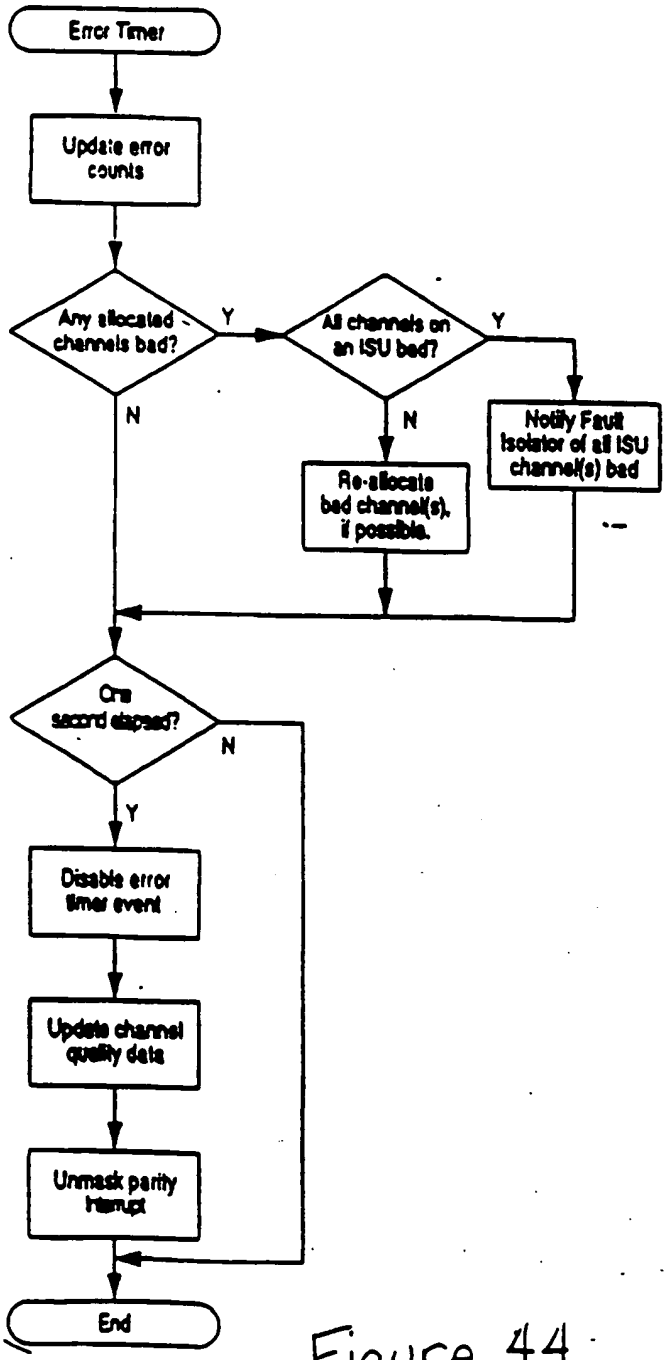

Error Timer
Update error counts
Any allocated channels bad?
Y
All channels on an ISU bad?
Y
N
N
Notify Fault Isolator of all ISU channel(s) bad
Re-allocate bad channel(s), if possible.
One second elapsed?
N
Y
Disable error timer event
Update channel quality data
Unmask parity interrupt
End

Figure 44

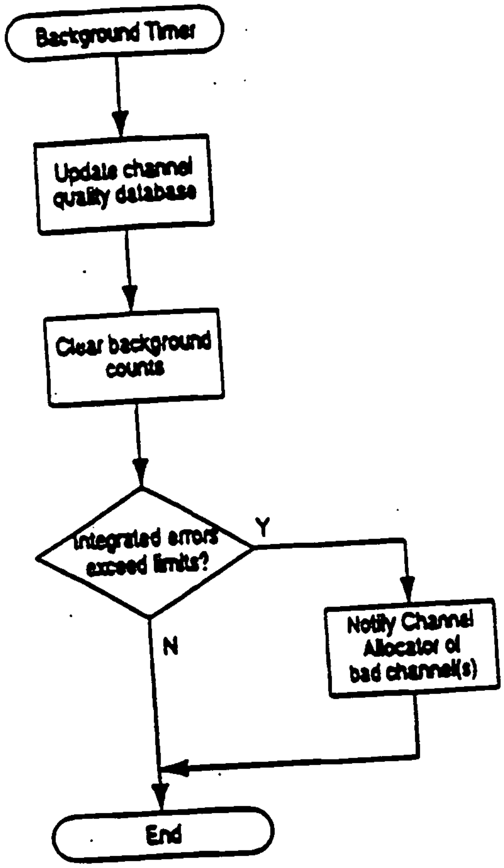


Figure 45

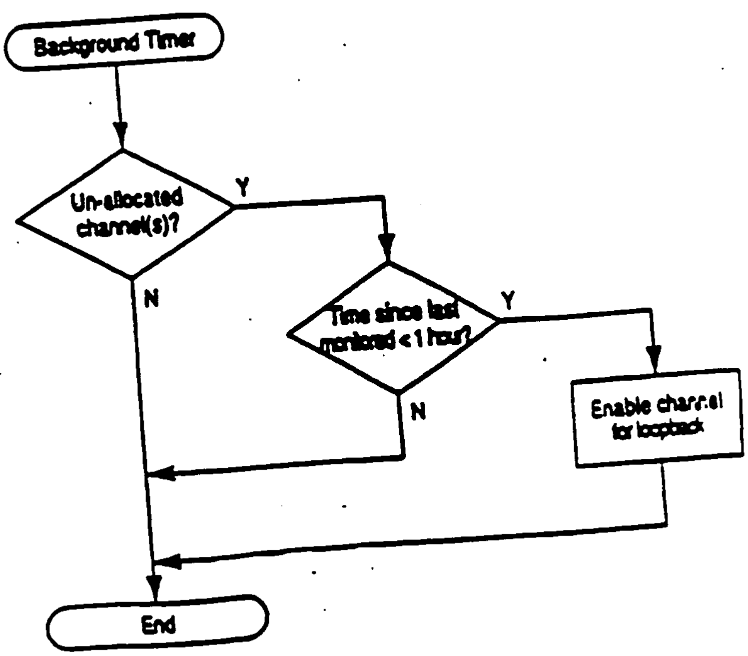


Figure 46

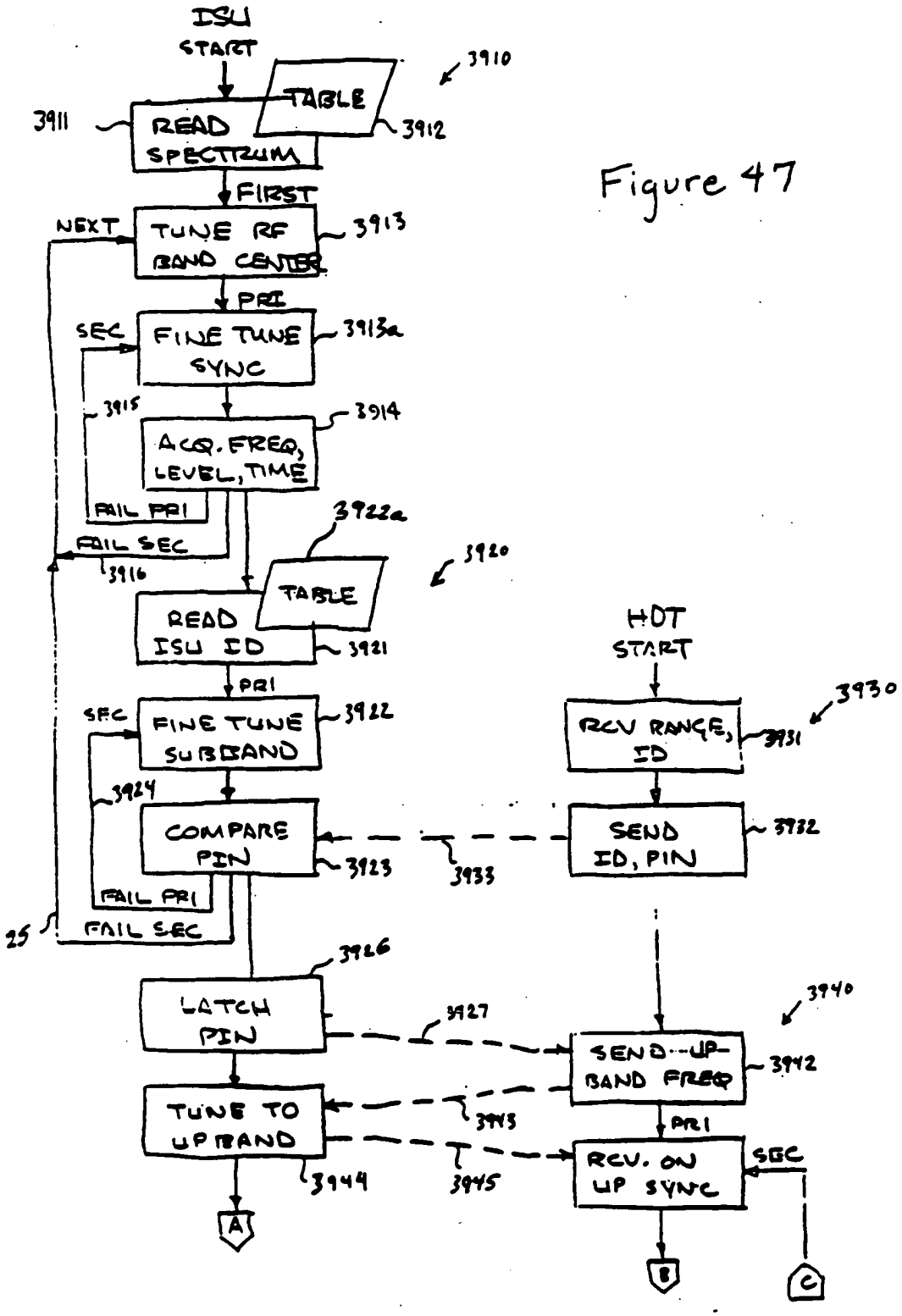


Figure 47

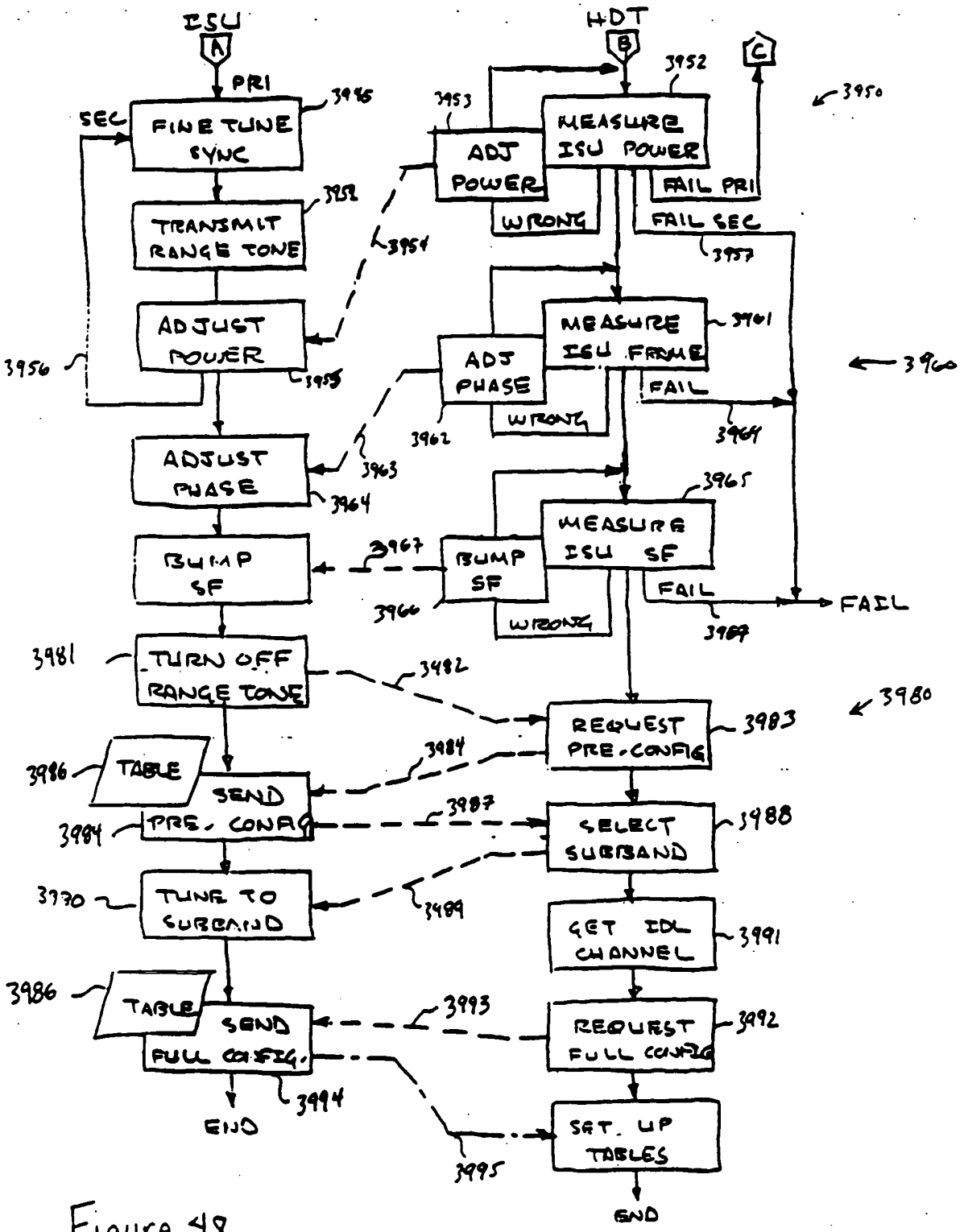
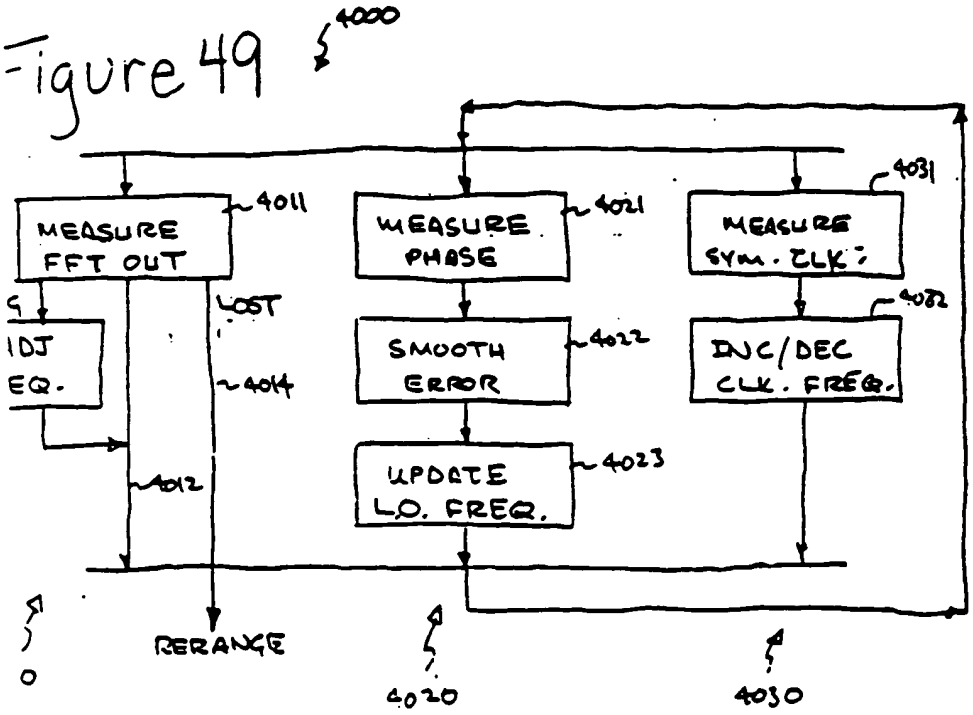
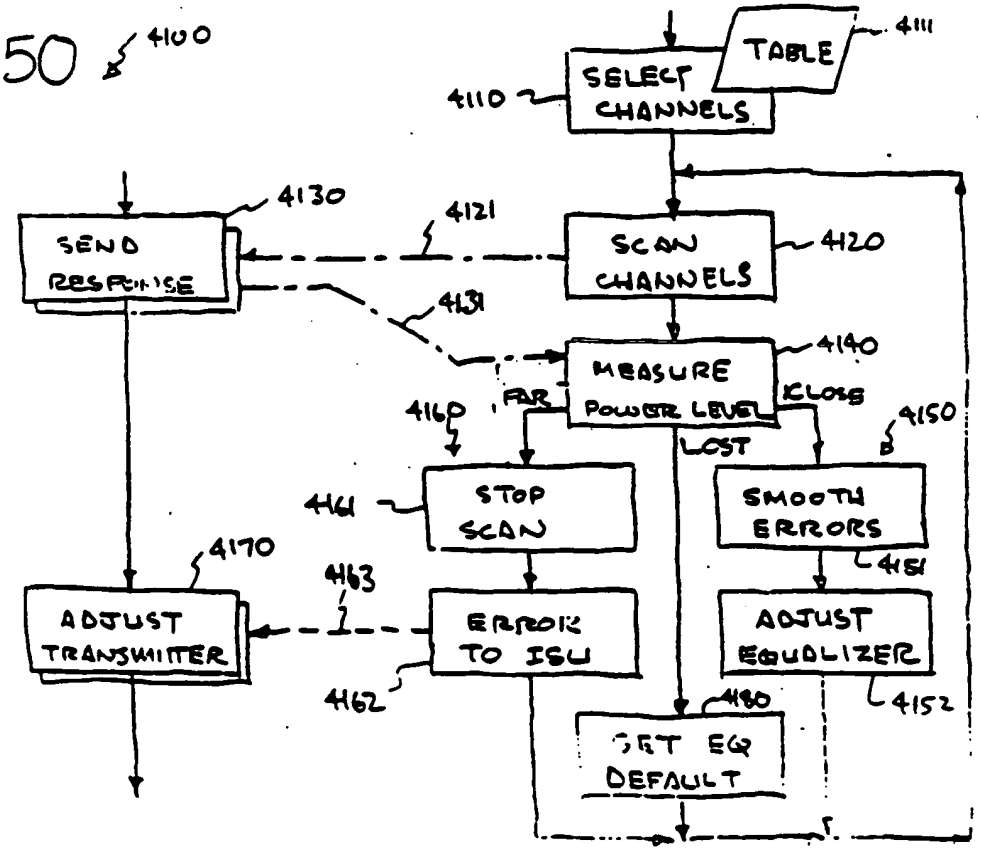

ISU
A
PRI
SEC
FINE TUNE SYNC
3946
TRANSMIT RANGE TONE
3952
ADJUST POWER
3955
3956
ADJUST PHASE
3964
BUMP SF
3967
TURN OFF RANGE TONE
3981
3982
TABLE
3986
SEND PRE-CONFIG
3984
3987
TUNE TO SUBBAND
3990
3989
TABLE
3986
SEND FULL CONFIG.
3993
3994
END
3995
HDT
B
C
3952
3953
MEASURE ISU POWER
3950
ADJ POWER
3954
WRONG
FAIL PRI
FAIL SEC
3957
MEASURE ISU FRAME
3961
3960
ADJ PHASE
3962
3963
WRONG
FAIL
3969
3965
MEASURE ISU SF
BUMP SF
3966
3967
WRONG
FAIL
FAIL
3969
3980
REQUEST PRE-CONFIG
3983
3984
SELECT SUBBAND
3988
3987
GET IDL CHANNEL
3991
REQUEST FULL CONFIG
3992
SET UP TABLES
END

Figure 48

Figure 49



ure 50



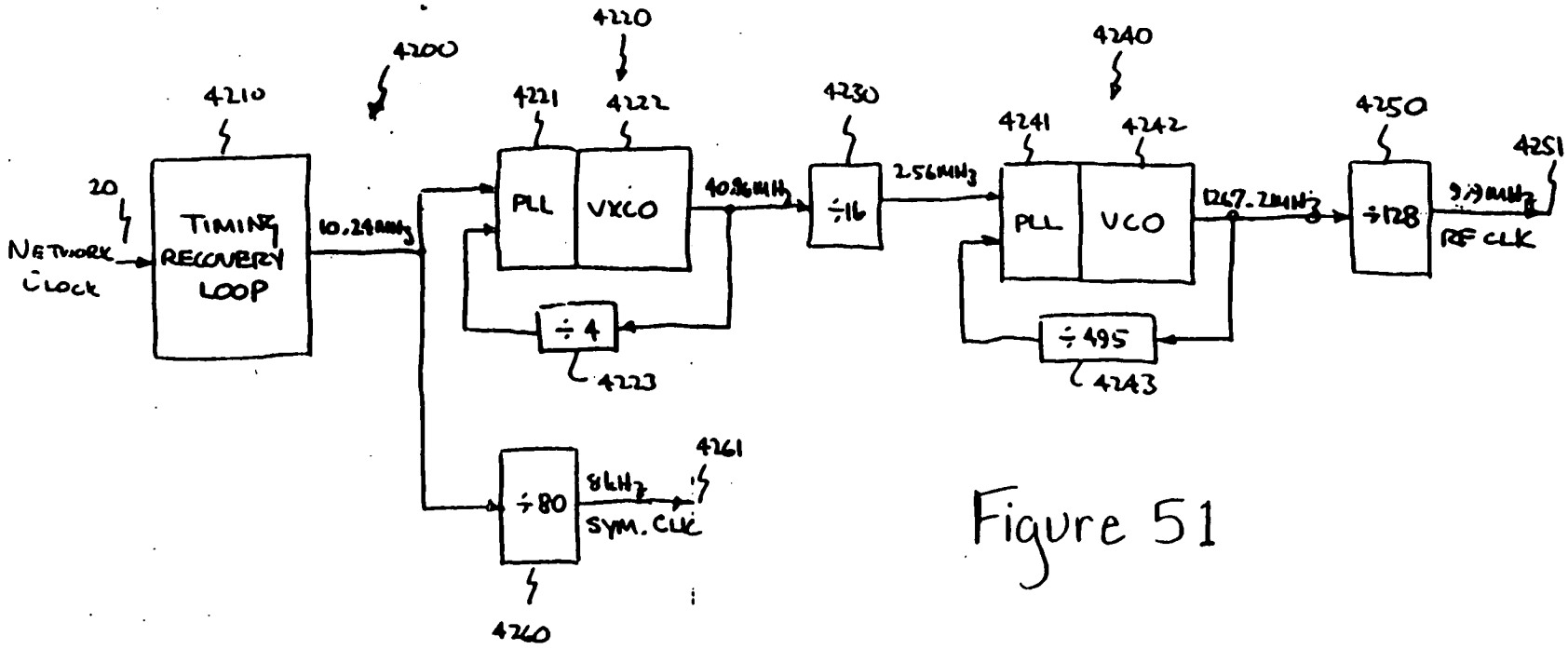


Figure 51

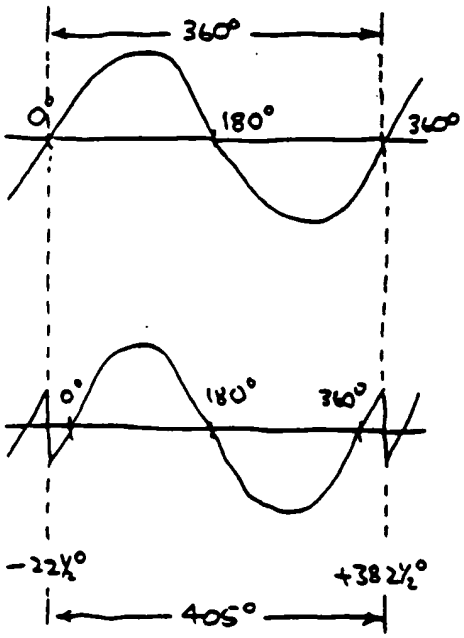


Figure 52

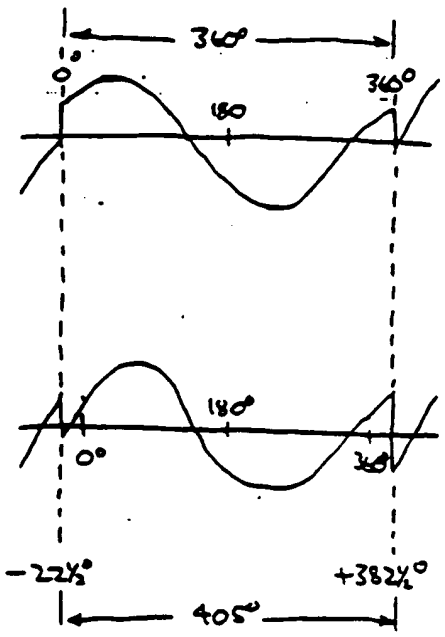


Figure 53

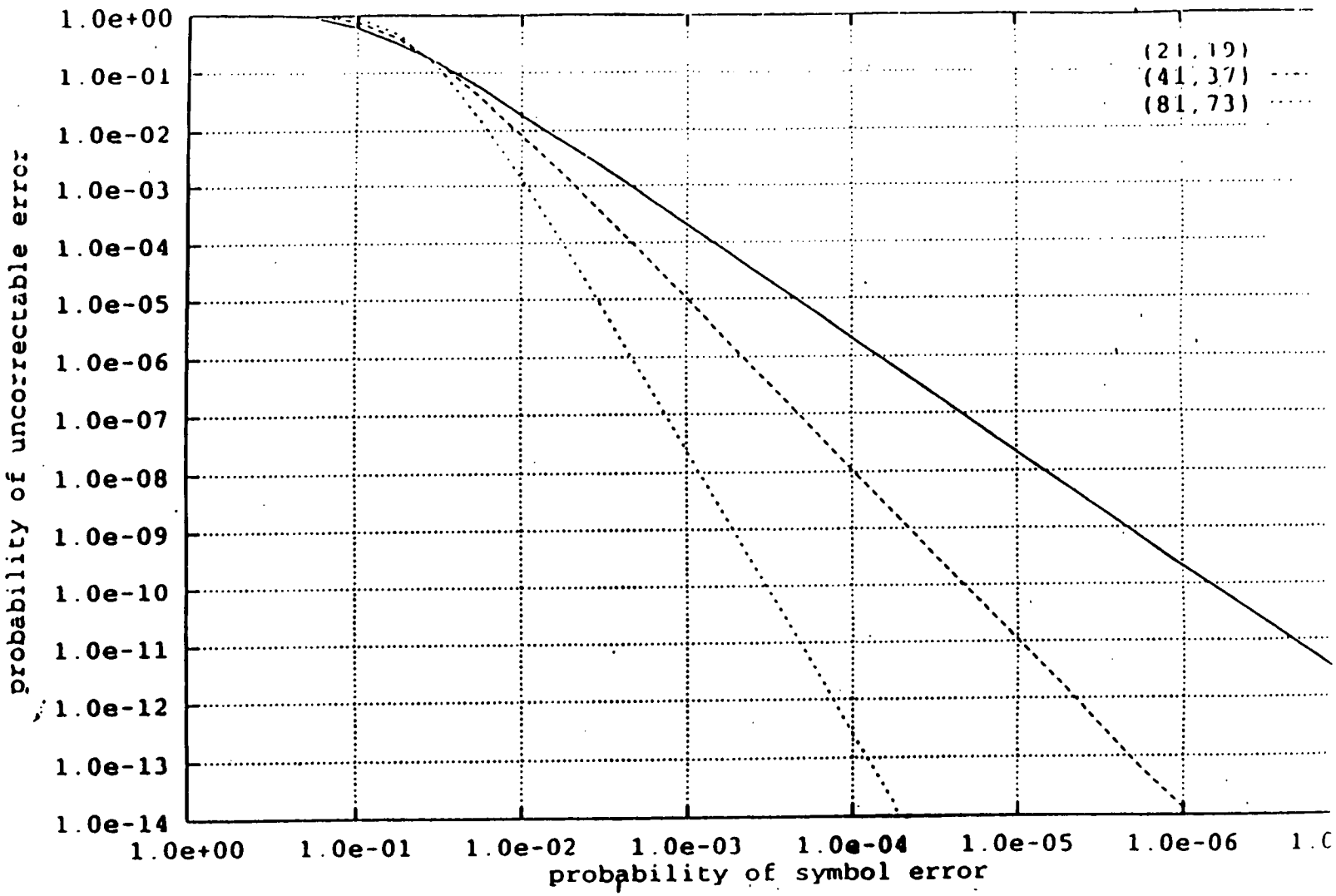

1.0e+00
1.0e-01
1.0e-02
1.0e-03
1.0e-04
1.0e-05
1.0e-06
1.0e-07
1.0e-08
1.0e-09
1.0e-10
1.0e-11
1.0e-12
1.0e-13
1.0e-14
probability of uncorrectable error
1.0e+00
1.0e-01
1.0e-02
1.0e-03
1.0e-04
1.0e-05
1.0e-06
probability of symbol error
(21,19)
(41,37)
(81,73)

Figure 5

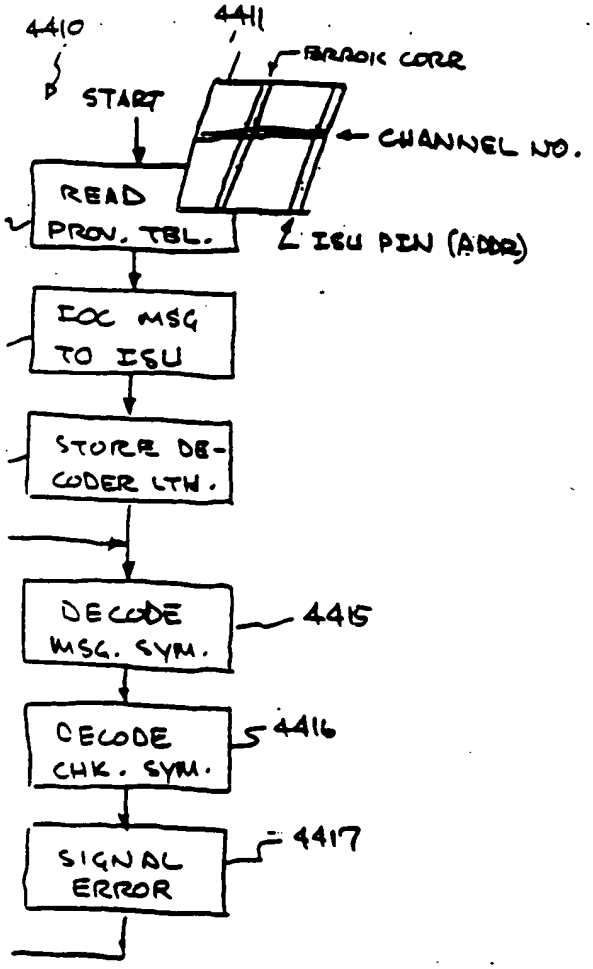


Figure 55

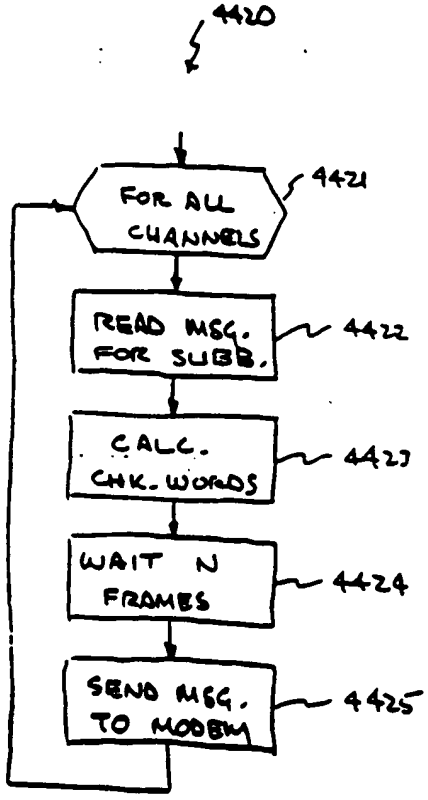


Figure 56

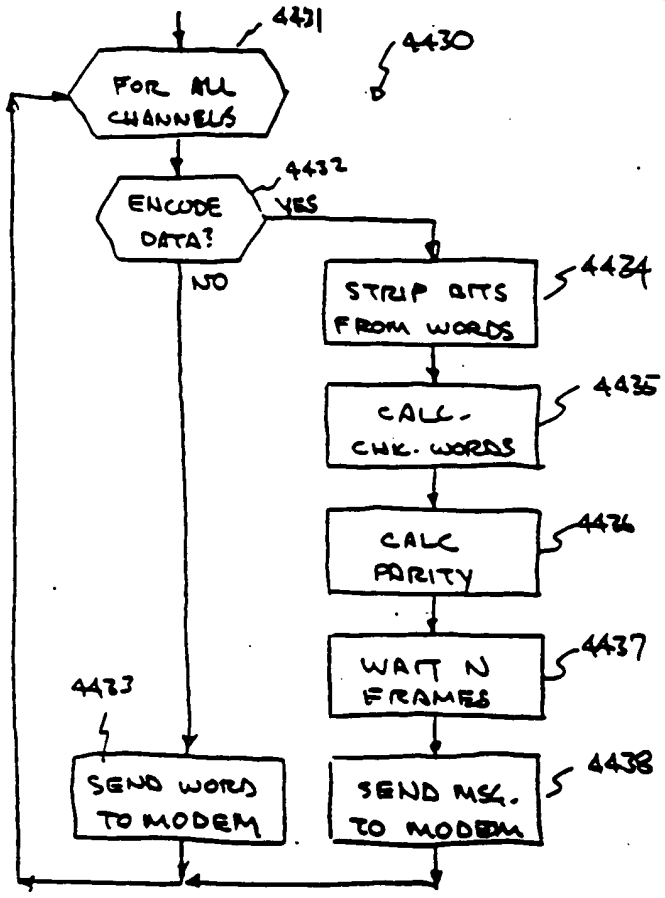

4431
4430
FOR ALL CHANNELS
4432
ENCODE DATA?
YES
NO
STRIP BITS FROM WORDS
4434
CALC. CHK. WORDS
4435
CALC PARITY
4436
WAIT N FRAMES
4437
4433
SEND WORD TO MODEM
SEND MSG. TO MODEM
4438

Figure 57

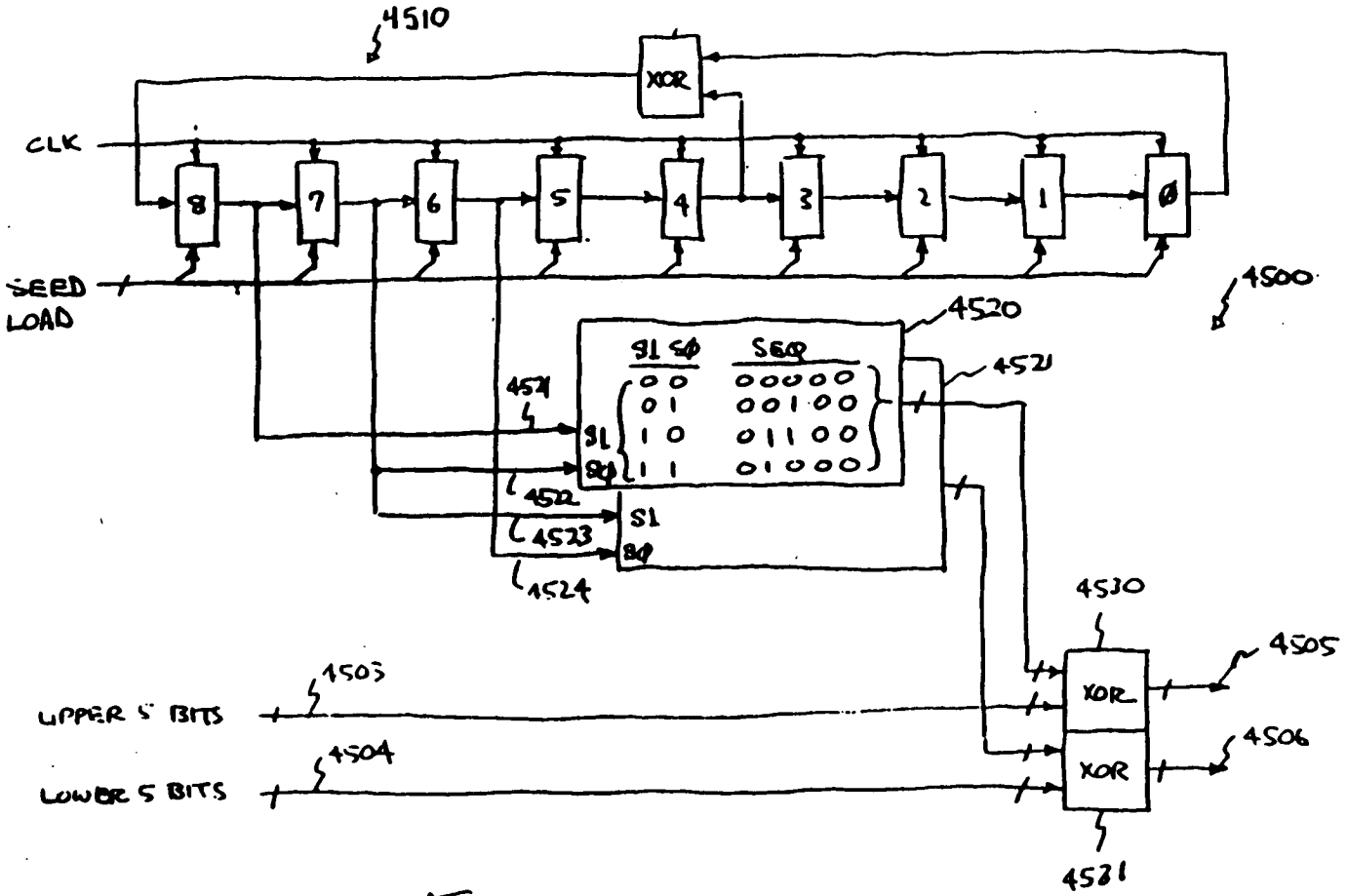
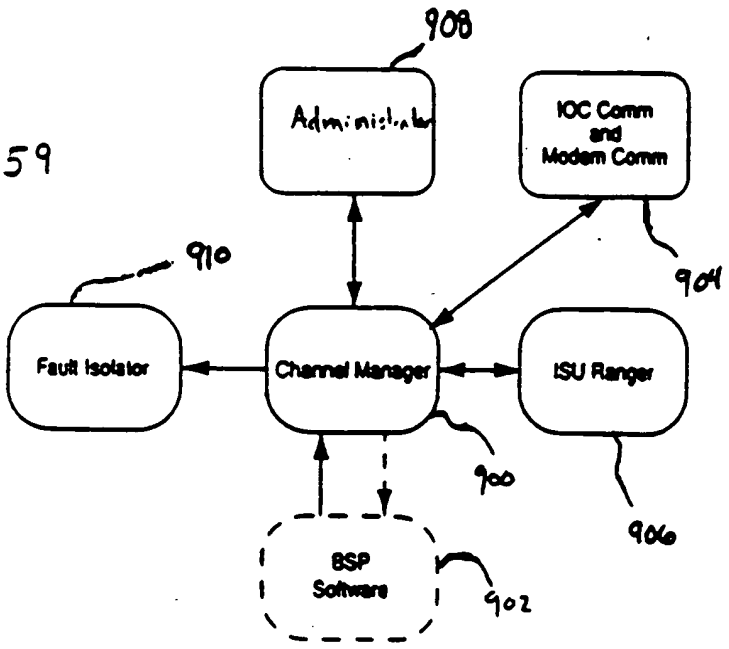

4510
XOR
CLK
8
7
6
5
4
3
2
1
0
SEED LOAD
4500
4520
S1 S0
S60
0 0
00000
0 1
00100
1 0
01100
1 1
01000
4521
4524
4522
S1
S0
4523
4530
4505
XOR
4503
UPPER 5 BITS
4504
LOWER 5 BITS
XOR
4506
4531

Figure 58

Figure 59


908
Administrator
IOC Comm and Modem Comm
904
910
Fault Isolator
Channel Manager
ISU Ranger
900
906
BSP Software
902

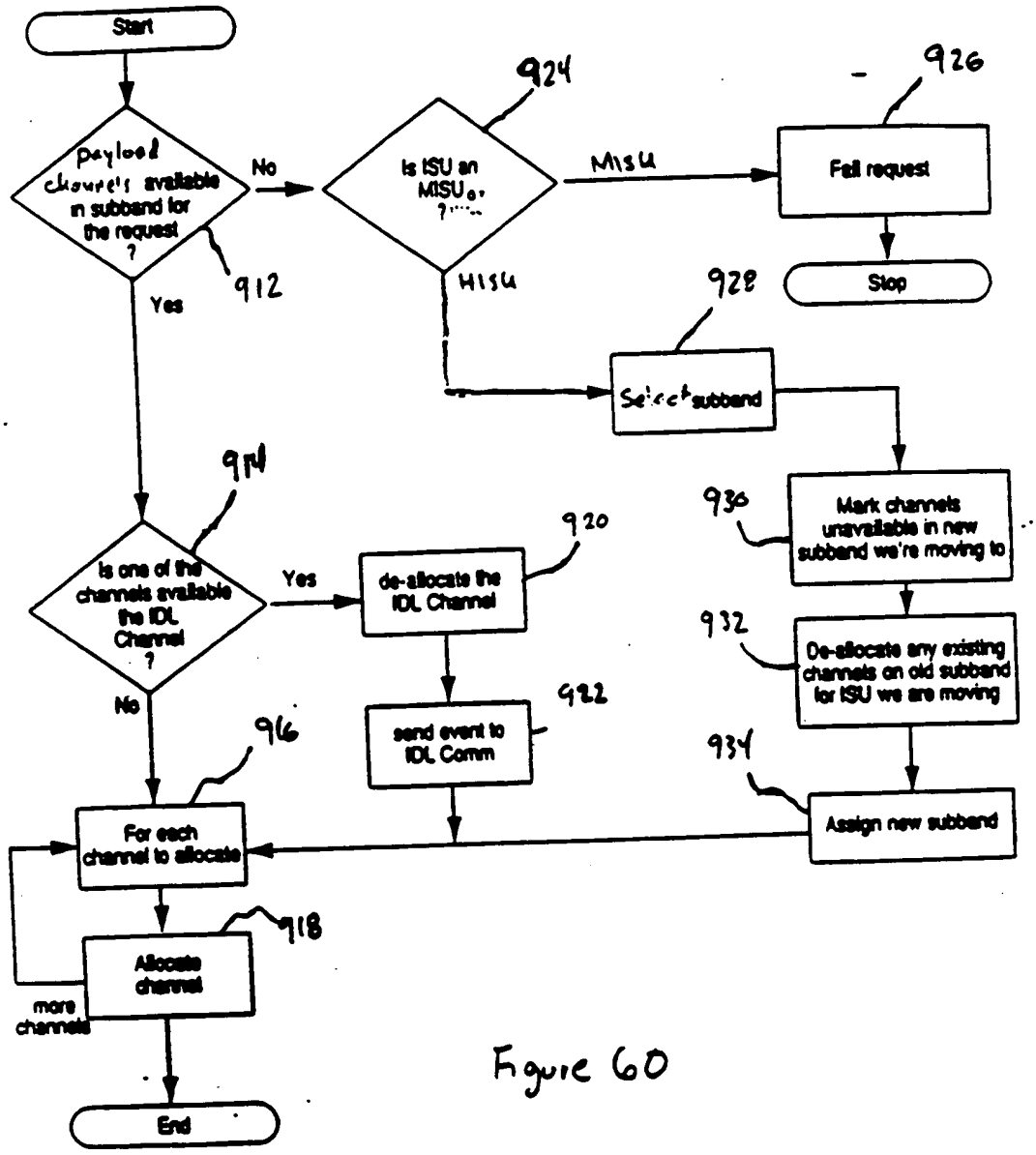

Start
payload channels available in subband for the request ?
No
912
Yes
Is ISU an MISU ?
924
MISU
HISU
Fail request
926
Stop
928
Select subband
930
Mark channels unavailable in new subband we're moving to
932
De-allocate any existing channels on old subband for ISU we are moving
934
Assign new subband
Is one of the channels available the IDL Channel ?
914
Yes
No
de-allocate the IDL Channel
920
send event to IDL Comm
922
For each channel to allocate
916
Allocate channel
918
more channels
End

Figure 60

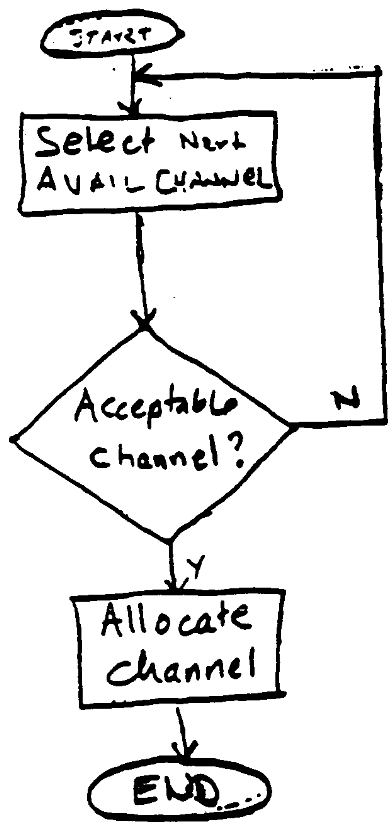

START
Select Next AVAIL CHANNEL
Acceptable channel?
N
Y
Allocate channel
END

Figure 61

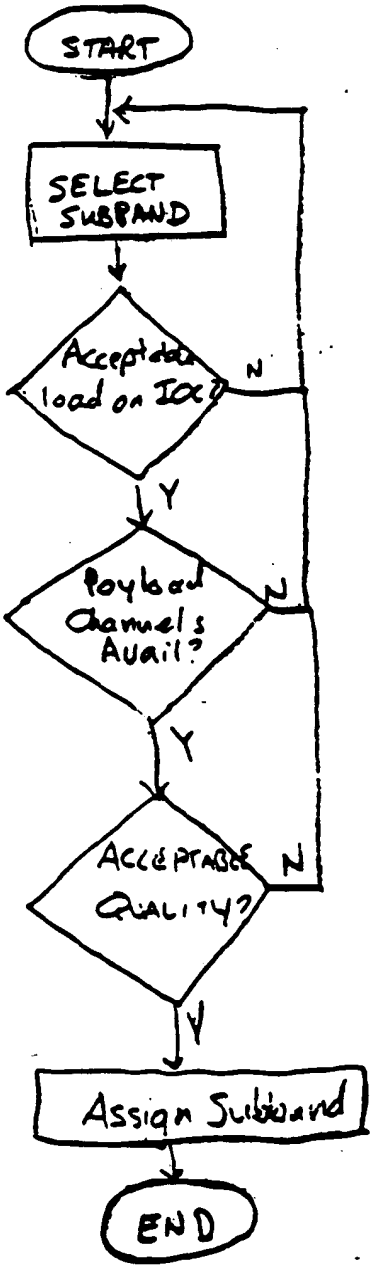

START
SELECT SUBBAND
Acceptable load on IOC?
N
Y
Payload Channels Avail?
N
Y
ACCEPTABLE QUALITY?
N
Y
Assign Subband
END

Figure 62

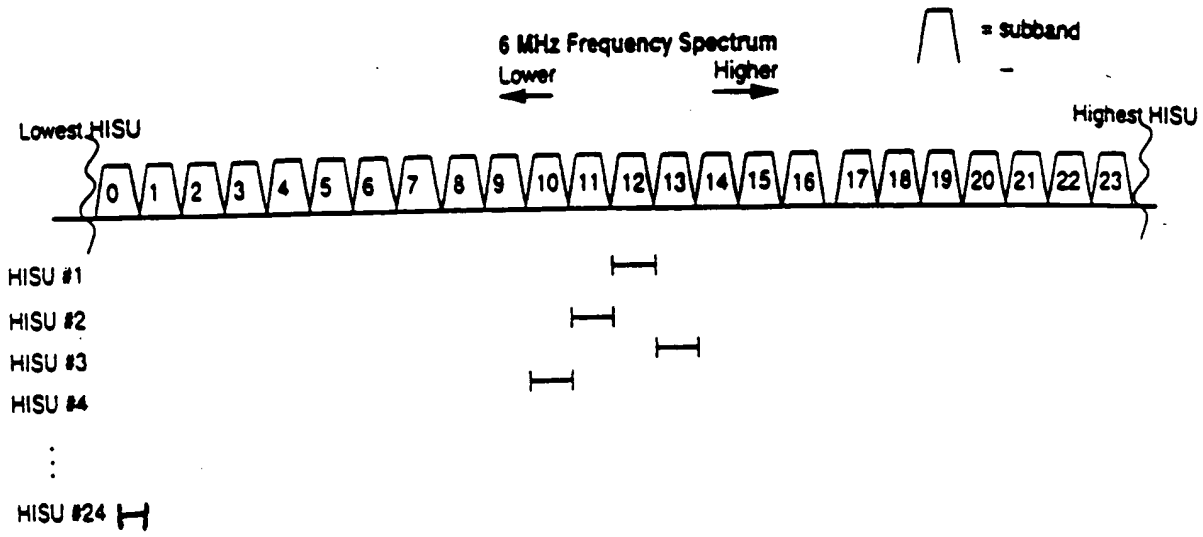


Figure 63

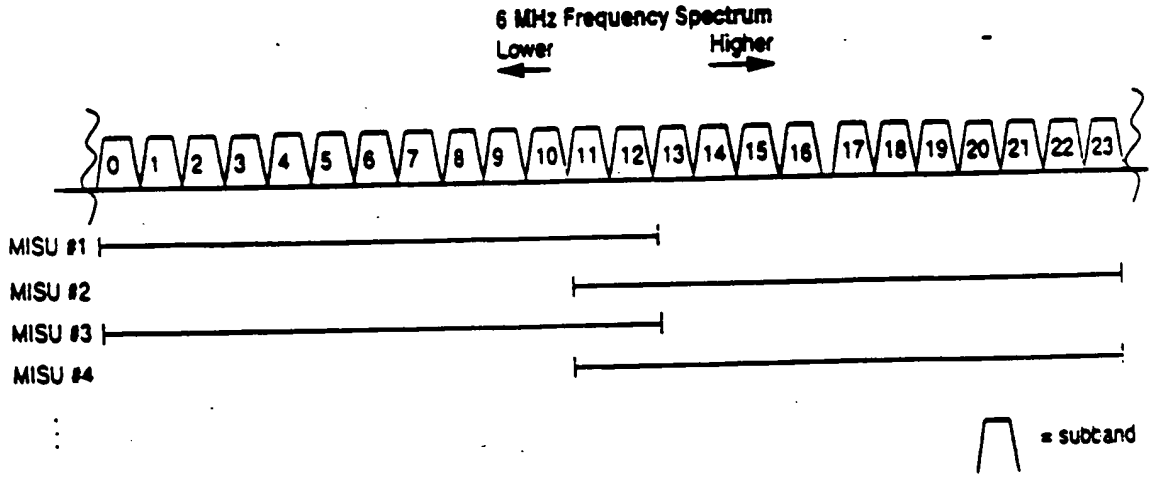


Figure 64

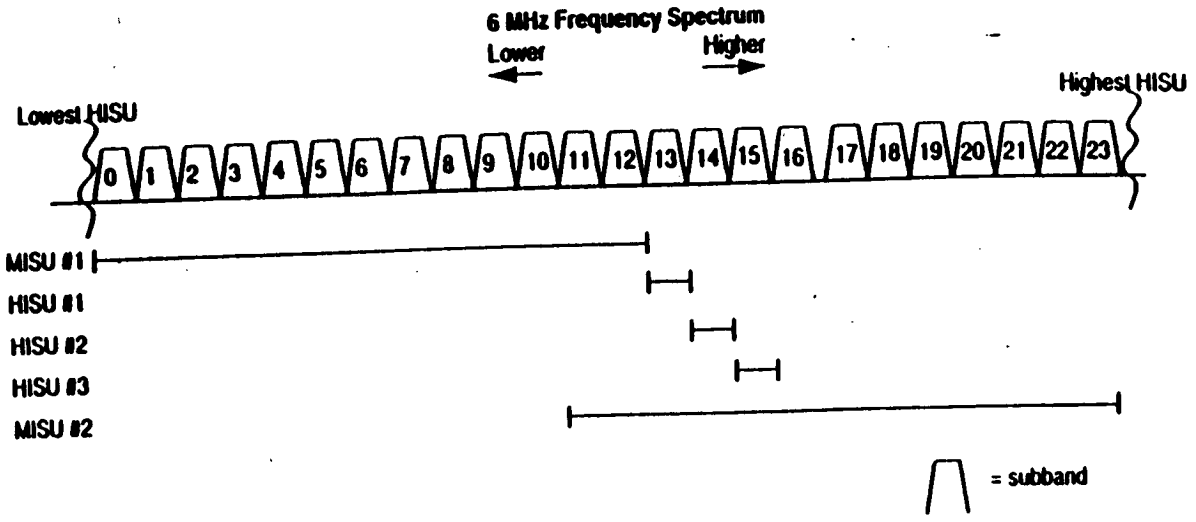


Figure 65

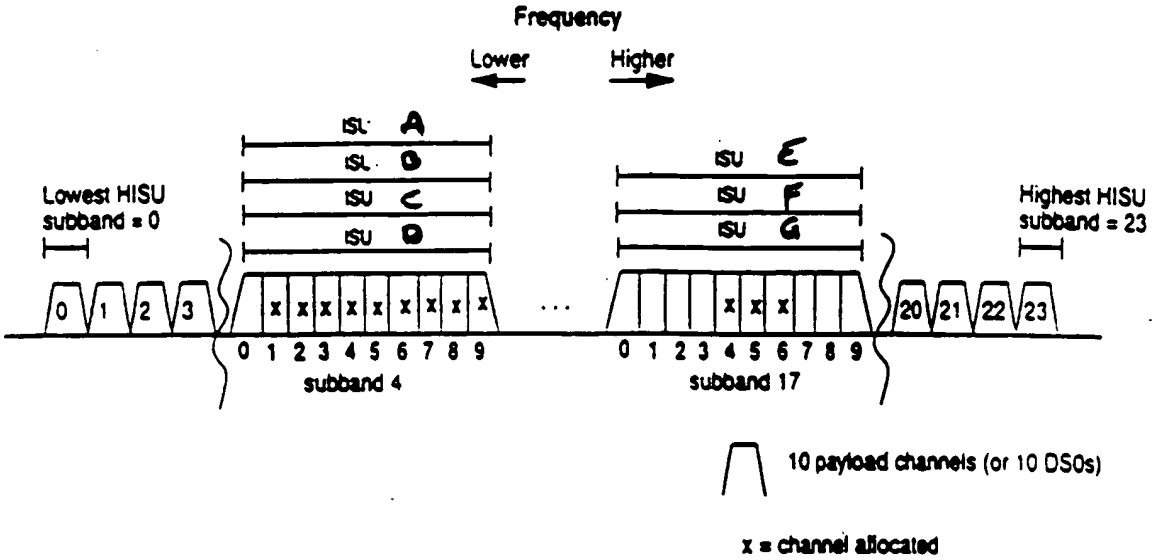


Figure 66

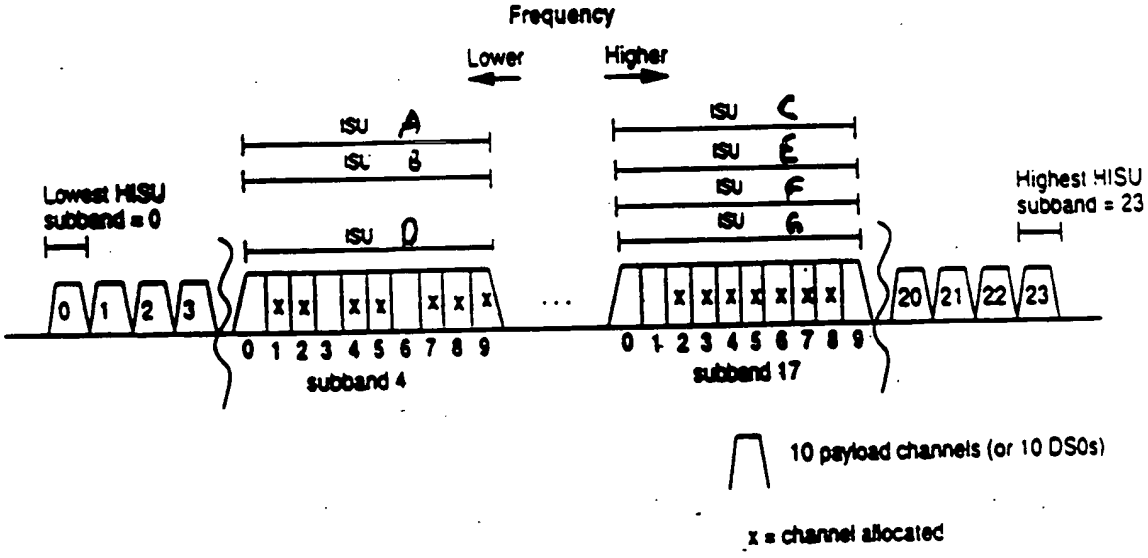


Figure 67

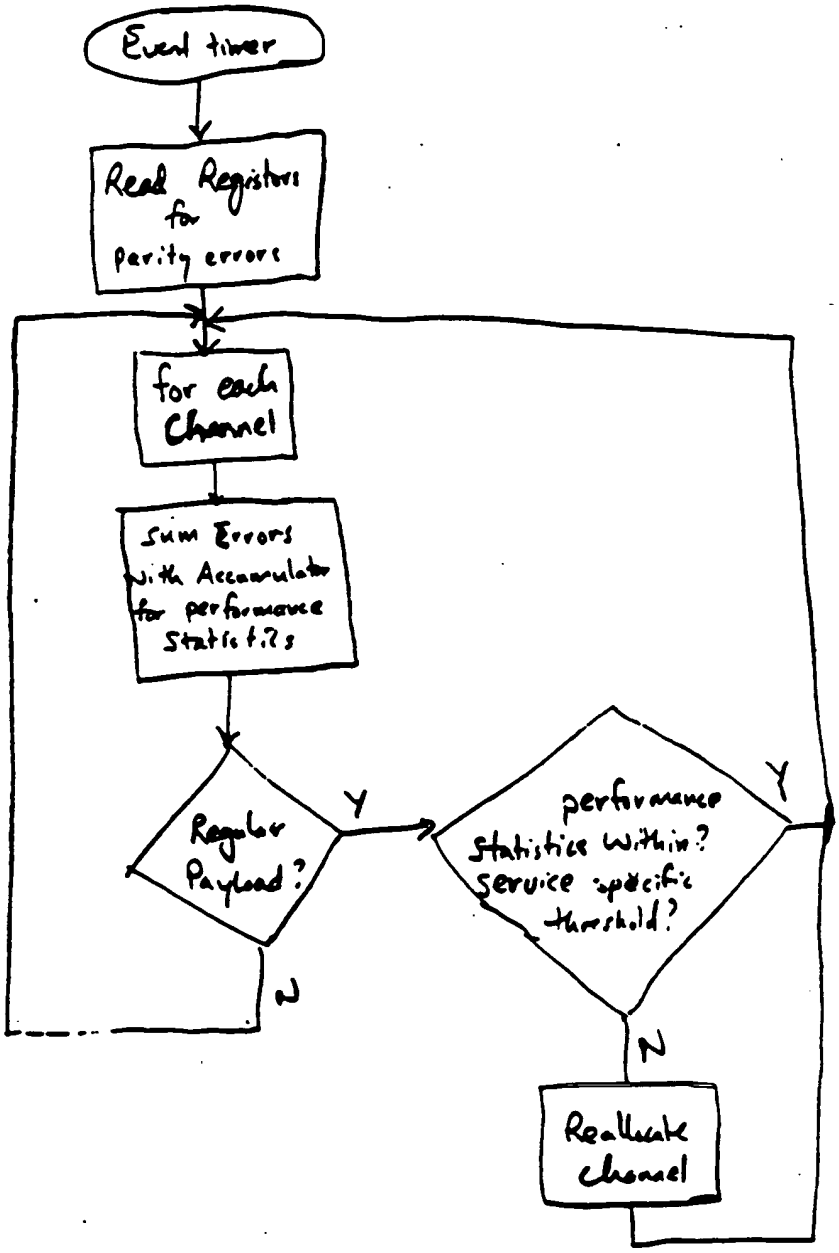


Figure 68

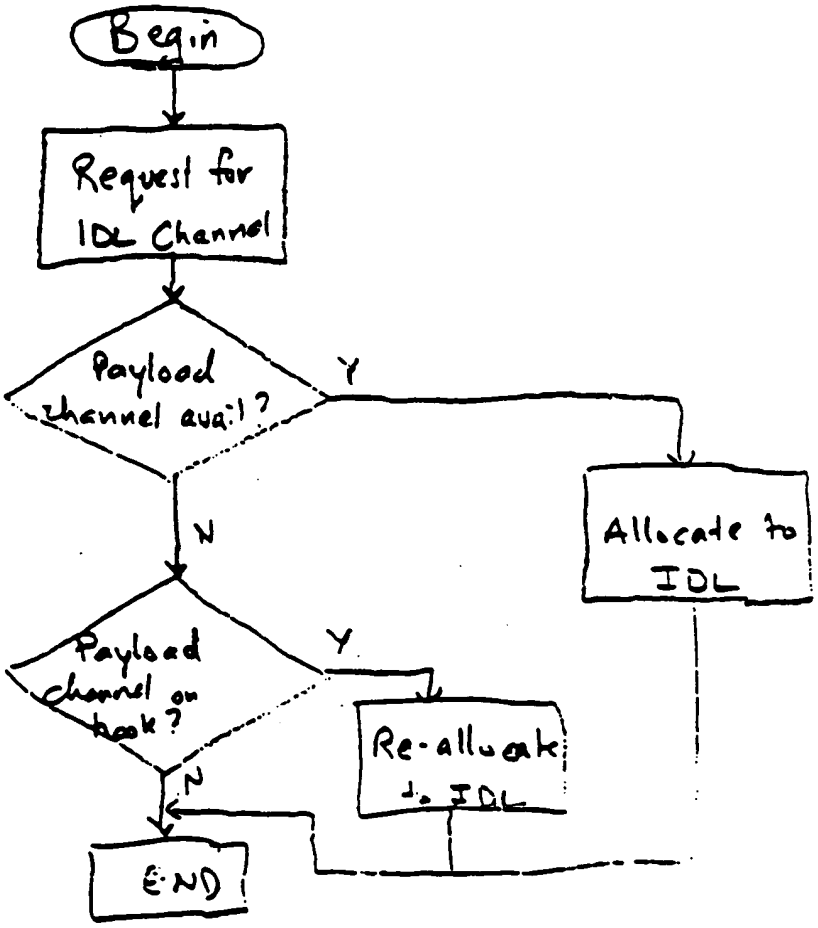

Begin
Request for IDL Channel
Payload channel avail?
Y
N
Allocate to IDL
Payload channel on hook?
Y
N
Re-allocate to IDL
END

Figure 69

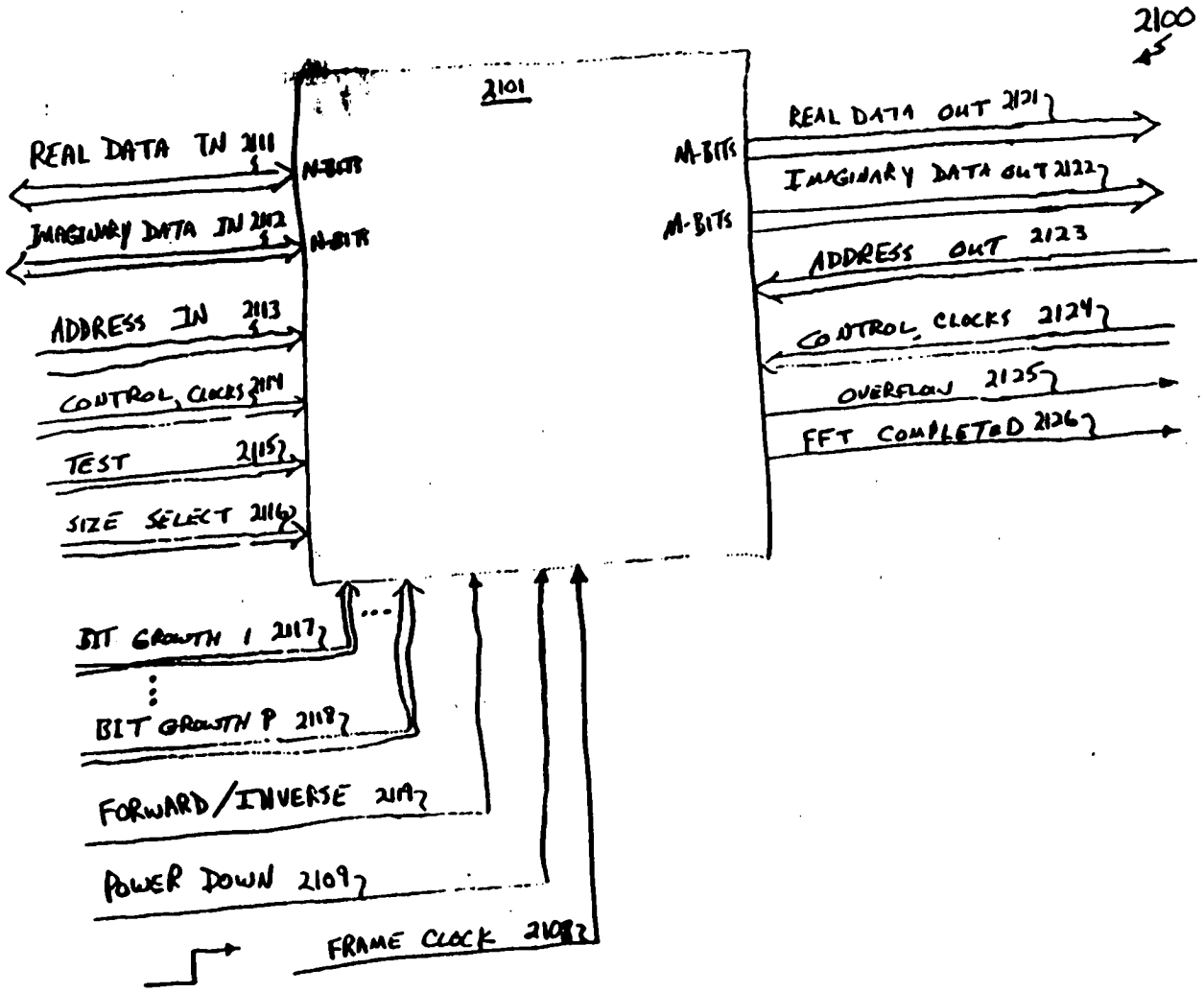


Figure 70

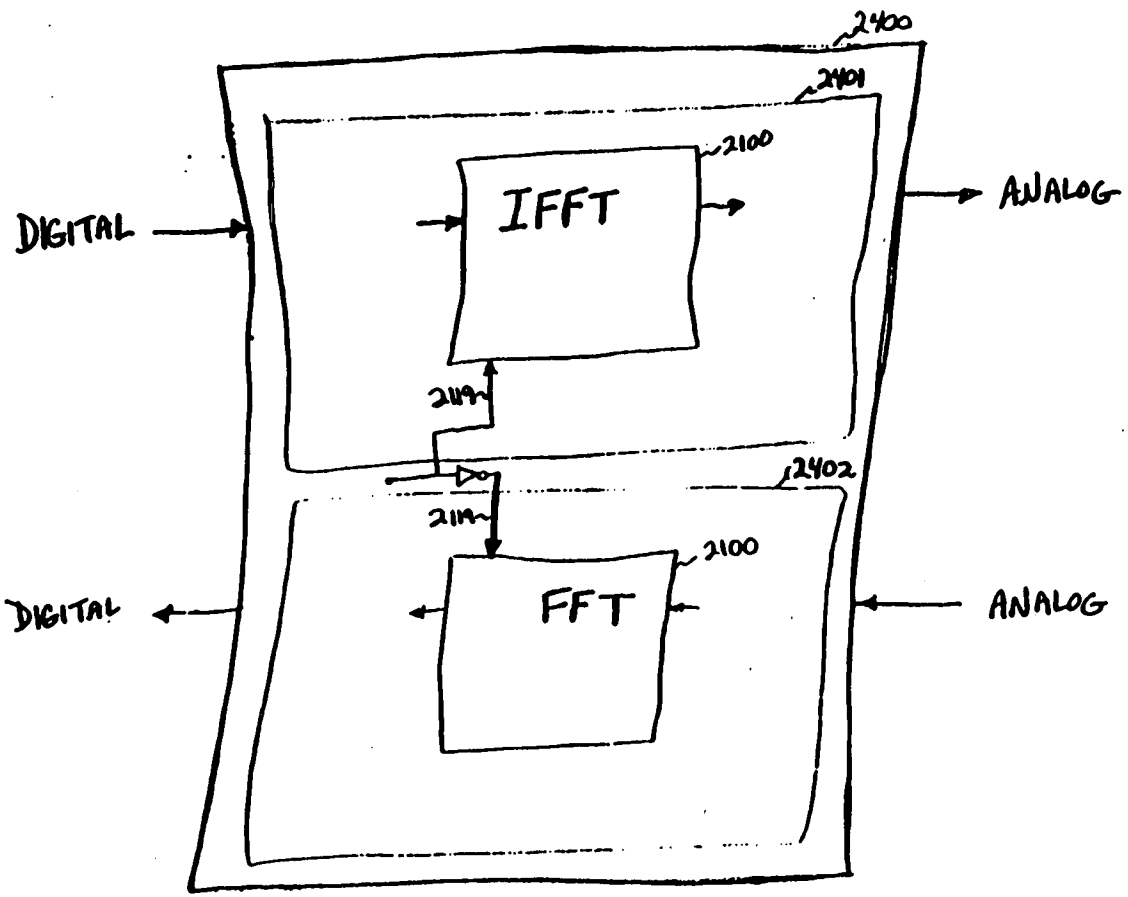


Figure 71

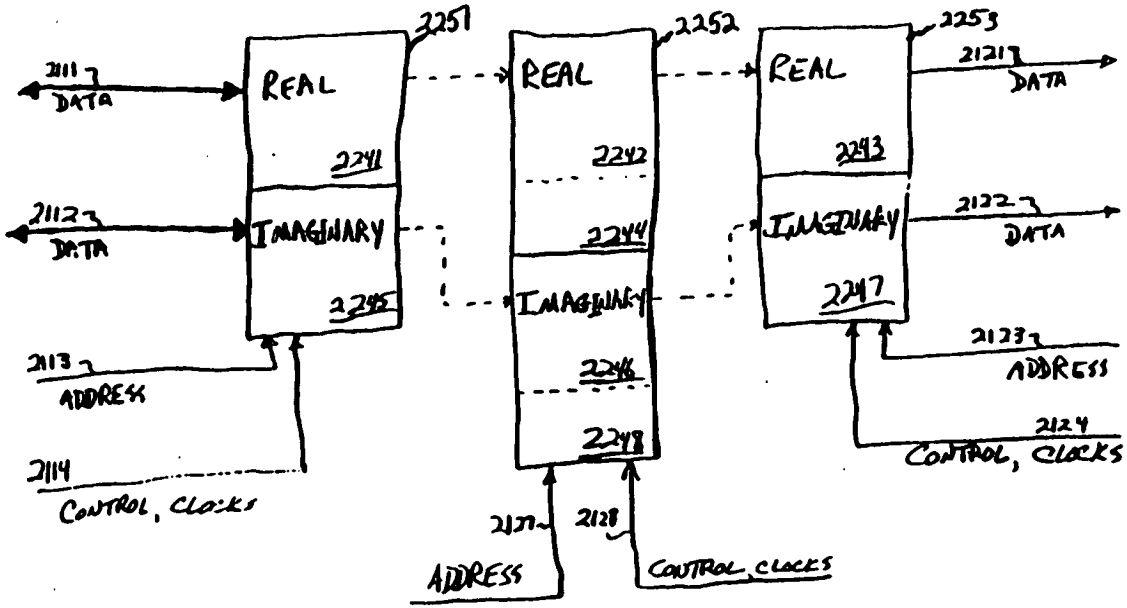


Figure 72

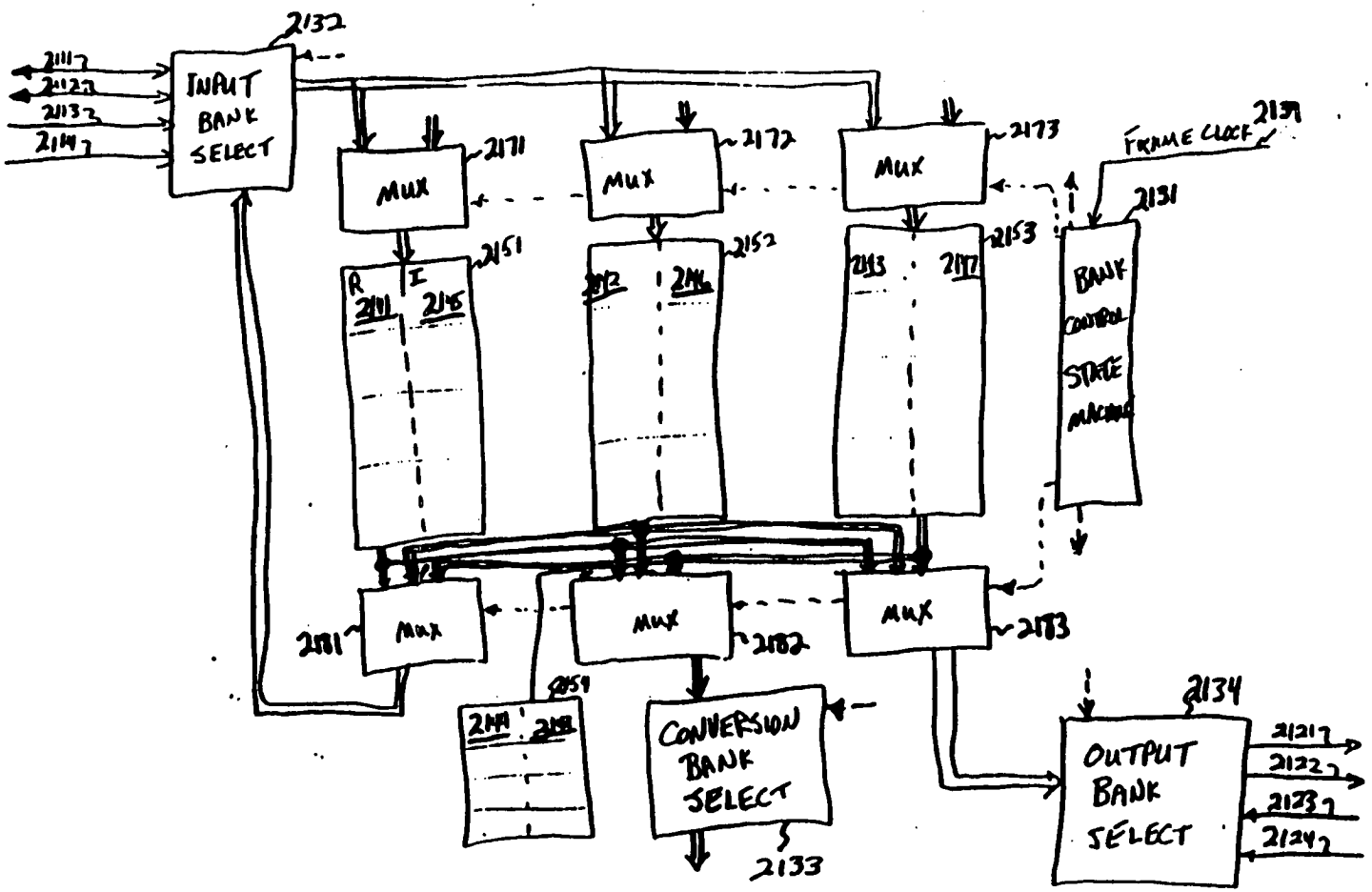
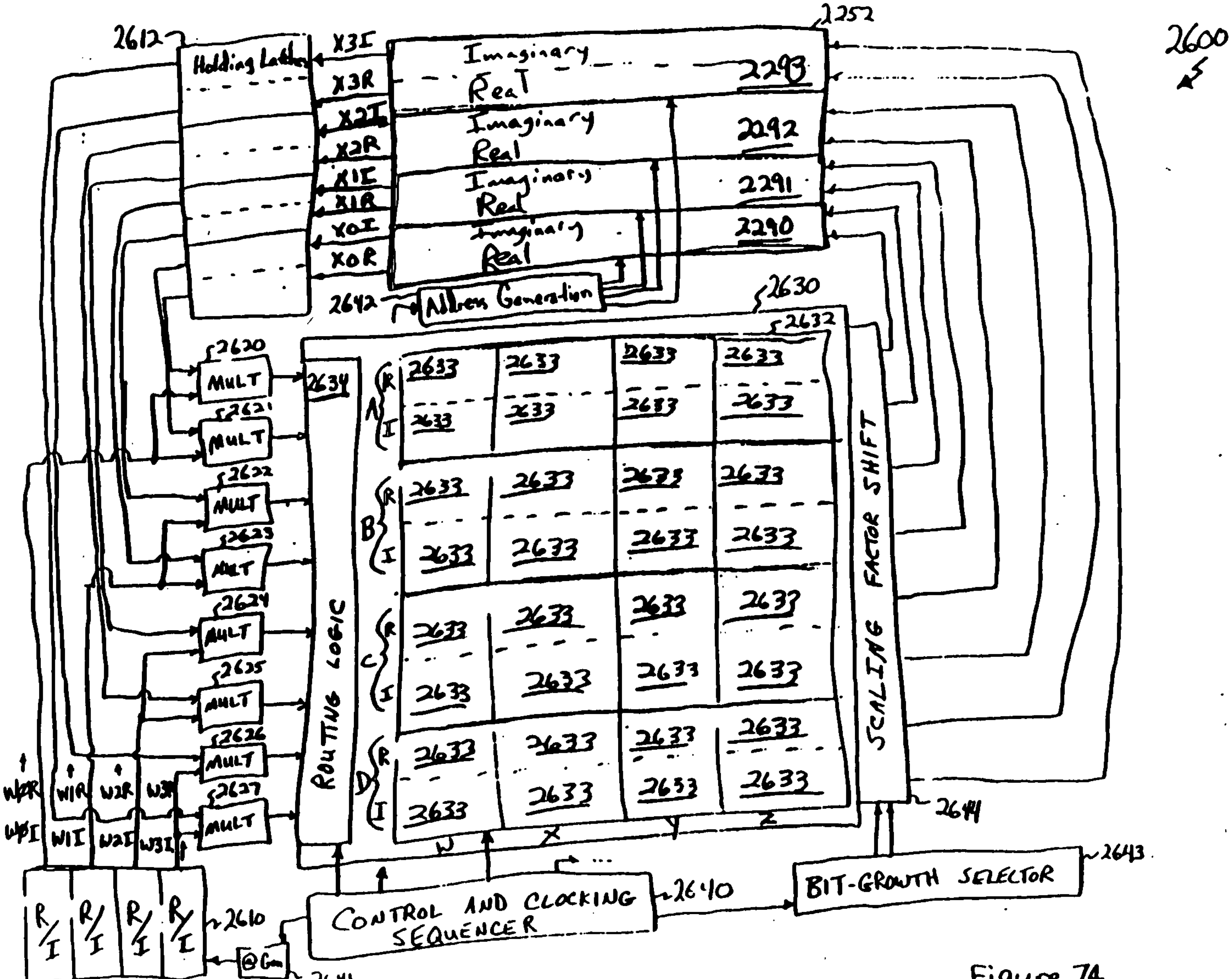


Figure 73



2600
2612
Holding Latches
X3I
X3R
X2I
X2R
X1I
X1R
X0I
X0R
2252
Imaginary
Real
2293
2292
2291
2290
2642
Address Generation
2630
2632
2634
ROUTING LOGIC
SCALING FACTOR SHIFT
2633
A
B
C
D
R
I
W
X
Y
Z
2620
2621
2622
2623
2624
2625
2626
2627
MULT
W0R
W0I
W1R
W1I
W2R
W2I
W3R
W3I
R/I
2610
@Gen
2641
CONTROL AND CLOCKING SEQUENCER
2640
BIT-GROWTH SELECTOR
2643
2644

Figure 74

Figure 75 THIS TABLE SHOWS THE ORDER OF CALCULATION FOR A NORMAL BUTTERFLY:

2800

C0

AWR = WR AWI = WI	AXR = XR AXI = XI	AYR = YR AYI = YI	AZR = ZR AZI = ZI
BWR = WR BWI = WI	BXR = XR BXI = XI	BYR = YR BYI = YI	BZR = ZR BZI = ZI
CWR = WR CWI = WI	CXR = XR CXI = XI	CYR = YR CYI = YI	CZR = ZR CZI = ZI
DWR = WR DWI = WI	DXR = XR DXI = XI	DYR = YR DYI = YI	DZR = ZR DZI = ZI

2632

Figure 76

C1

AWR = AWR - WI AWI = AWI + WR	AXR = AXR - XI AXI = AXI + XR	AYR = AYR - YI AYI = AYI + YR	AZR = AZR - ZI AZI = AZI + ZR
BWR = BWR - WI BWI = BWI + WR	BXR = BXR - XI BXI = BXI + XR	BYR = BYR - YI BYI = BYI + YR	BZR = BZR - ZI BZI = BZI + ZR
CWR = CWR - WI CWI = CWI + WR	CXR = CXR - XI CXI = CXI + XR	CYR = CYR - YI CYI = CYI + YR	CZR = CZR - ZI CZI = CZI + ZR
DWR = DWR - WI DWI = DWI + WR	DXR = DXR - XI DXI = DXI + XR	DYR = DYR - YI DYI = DYI + YR	DZR = DZR - ZI DZI = DZI + ZR

2632

Figure 77

2800

2632

C2			
AWR = AWR + WR AWI = AWI + WI	AXR = AXR + XI AXI = AXI - XR	AYR = AYR - YR AYI = AYI - YI	AZR = AZR - ZI AZI = AZI + ZR
BWR = BWR + WR BWI = BWI + WI	BXR = BXR + XI BXI = BXI - XR	BYR = BYR - YR BYI = BYI - YI	BZR = BZR - ZI BZI = BZI + ZR
CWR = CWR + WR CWI = CWI + WI	CXR = CXR + XI CXI = CXI - XR	CYR = CYR - YR CYI = CYI - YI	CZR = CZR - ZI CZI = CZI + ZR
DWR = DWR + WR DWI = DWI + WI	DXR = DXR + XI DXI = DXI - XR	DYR = DYR - YR DYI = DYI - YI	DZR = DZR - ZI DZI = DZI + ZR

Figure 78

2800

2632

C3			
AWR = AWR - WI AWI = AWI + WR	AXR = AXR + XR AXI = AXI + XI	AYR = AYR + YI AYI = AYI - YR	AZR = AZR - ZR AZI = AZI - ZI
BWR = BWR - WI BWI = BWI + WR	BXR = BXR + XR BXI = BXI + XI	BYR = BYR + YI BYI = BYI - YR	BZR = BZR - ZR BZI = BZI - ZI
CWR = CWR - WI CWI = CWI + WR	CXR = CXR + XR CXI = CXI + XI	CYR = CYR + YI CYI = CYI - YR	CZR = CZR - ZR CZI = CZI - ZI
DWR = DWR - WI DWI = DWI + WR	DXR = DXR + XR DXI = DXI + XI	DYR = DYR + YI DYI = DYI - YR	DZR = DZR - ZR DZI = DZI - ZI

Figure 79

C4

AWR = AWR + WR AWI = AWI + WI	AXR = AXR - XR AXI = AXI - XI	AYR = AYR + YR AYI = AYI + YI	AZR = AZR - ZR AZI = AZI - ZI
BWR = BWR + WR BWI = BWI + WI	BXR = BXR - XR BXI = BXI - XI	BYR = BYR + YR BYI = BYI + YI	BZR = BZR - ZR BZI = BZI - ZI
CWR = CWR + WR CWI = CWI + WI	CXR = CXR - XR CXI = CXI - XI	CYR = CYR + YR CYI = CYI + YI	CZR = CZR - ZR CZI = CZI - ZI
DWR = DWR + WR DWI = DWI + WI	DXR = DXR - XR DXI = DXI - XI	DYR = DYR + YR DYI = DYI + YI	DZR = DZR - ZR DZI = DZI - ZI

2800

2632

Figure 80

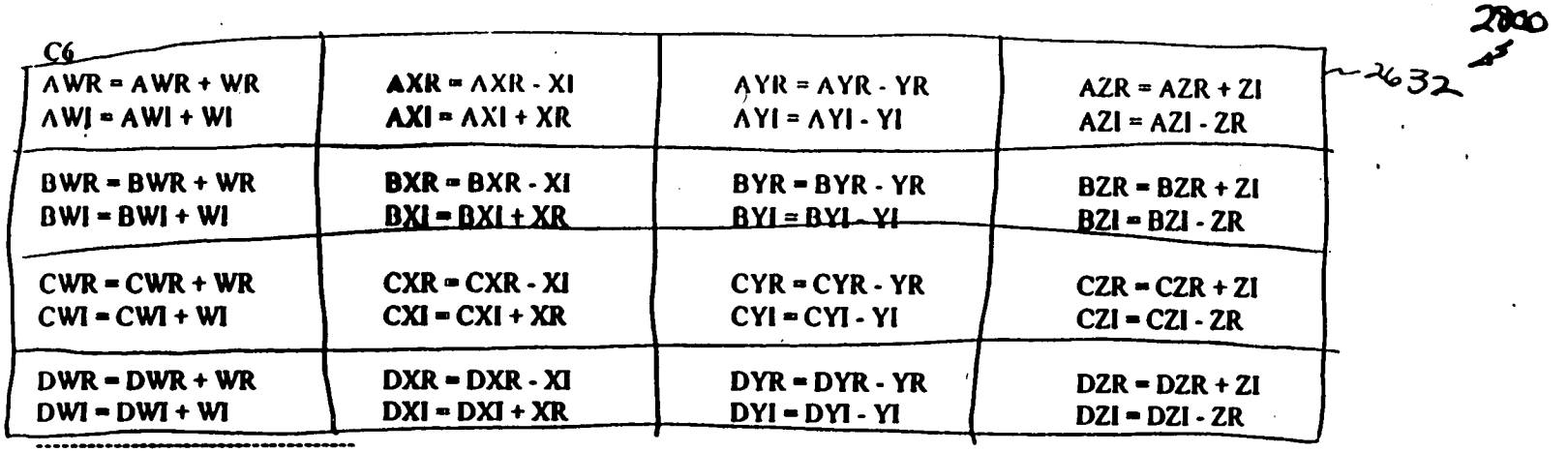
C5

AWR = AWR - WI AWI = AWI + WR	AXR = AXR + XI AXI = AXI - XR	AYR = AYR - YI AYI = AYI + YR	AZR = AZR + ZI AZI = AZI - ZR
BWR = BWR - WI BWI = BWI + WR	BXR = BXR + XI BXI = BXI - XR	BYR = BYR - YI BYI = BYI + YR	BZR = BZR + ZI BZI = BZI - ZR
CWR = CWR - WI CWI = CWI + WR	CXR = CXR + XI CXI = CXI - XR	CYR = CYR - YI CYI = CYI + YR	CZR = CZR + ZI CZI = CZI - ZR
DWR = DWR - WI DWI = DWI + WR	DXR = DXR + XI DXI = DXI - XR	DYR = DYR - YI DYI = DYI + YR	DZR = DZR + ZI DZI = DZI - ZR

2800

2632

Figure 81



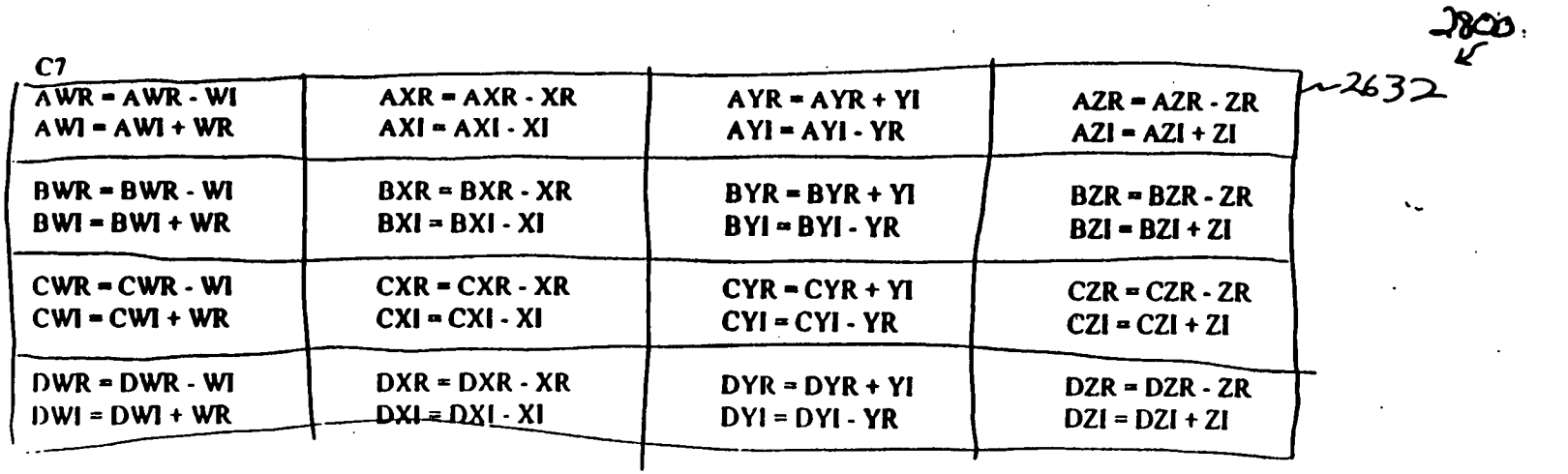
C6

AWR = AWR + WR AWI = AWI + WI	AXR = AXR - XI AXI = AXI + XR	AYR = AYR - YR AYI = AYI - YI	AZR = AZR + ZI AZI = AZI - ZR
BWR = BWR + WR BWI = BWI + WI	BXR = BXR - XI BXI = BXI + XR	BYR = BYR - YR BYI = BYI - YI	BZR = BZR + ZI BZI = BZI - ZR
CWR = CWR + WR CWI = CWI + WI	CXR = CXR - XI CXI = CXI + XR	CYR = CYR - YR CYI = CYI - YI	CZR = CZR + ZI CZI = CZI - ZR
DWR = DWR + WR DWI = DWI + WI	DXR = DXR - XI DXI = DXI + XR	DYR = DYR - YR DYI = DYI - YI	DZR = DZR + ZI DZI = DZI - ZR

2800

2632

Figure 82



C7

AWR = AWR - WI AWI = AWI + WR	AXR = AXR - XR AXI = AXI - XI	AYR = AYR + YI AYI = AYI - YR	AZR = AZR - ZR AZI = AZI + ZI
BWR = BWR - WI BWI = BWI + WR	BXR = BXR - XR BXI = BXI - XI	BYR = BYR + YI BYI = BYI - YR	BZR = BZR - ZR BZI = BZI + ZI
CWR = CWR - WI CWI = CWI + WR	CXR = CXR - XR CXI = CXI - XI	CYR = CYR + YI CYI = CYI - YR	CZR = CZR - ZR CZI = CZI + ZI
DWR = DWR - WI DWI = DWI + WR	DXR = DXR - XR DXI = DXI - XI	DYR = DYR + YI DYI = DYI - YR	DZR = DZR - ZR DZI = DZI + ZI

2800

2632

Figure 83 THIS TABLE SHOWS THE ORDER OF CALCULATION FOR A TRANSPOSED BUTTERFLY: 2810

2632

C0 :			
AWR = WR + XR + YR + ZR AWI = WI + XI + YI + ZI	AXR = WR - XI - YR + ZI AXI = WI + XR - YI - ZR	AYR = WR - XR + YR - ZR AYI = WI - XI + YI - ZI	AZR = WR + XI - YR - ZI AZI = WI - XR - YI + ZR
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

Figure 84 2810

2632

C1			
AWR = AWR-(WI + XI + YI +ZI) AWI = AWI +(WR +XR +YR +ZR)	AXR = AXR - (WI +XR -YI -ZR) AXI = AXI + (WR - XI - YR + ZI)	AYR = AYR-(WI - XI + YI - ZI) AYI = AYI +(WR -XR +YR -ZR)	AZR = AZR-(WI -XR -YI +ZR) AZI = AZI+(WR +XI -YR -ZI)
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

Figure 85

2810

2632

C2

. .	. .	. .	. .
BWR = WR + XR + YR + ZR BWI = WI + XI + YI + ZI	BXR = WR - XI - YR + ZI BXI = WI + XR - YI - ZR	BYR = WR - XR + YR - ZR BYI = WI - XI + YI - ZI	BZR = WR + XI - YR - ZI BZI = WI - XR - YI + ZR
. .	. .	. .	. .
. .	. .	. .	. .

Figure 86

2810

2632

C3

. .	. .	. .	. .
BWR = BWR -(WI + XI + YI + ZI) BWI = BWI +(WR +XR +YR +ZR)	BXR = BXR -(WI +XR -YI -ZR) BXI = BXI +(WR -XI -YR +ZI)	BYR = BYR - (WI -XI +YI -ZI) BYI = BYI+(WR -XR +YR -ZR)	BZR = BZR -(WI -XR -YI +ZR) BZI = BZI + (WR +XI -YR -ZI)
. .	. .	. .	. .
. .	. .	. .	. .

Figure 87

2810

2632

C4

. .	. .	. .	. .
. .	. .	. .	. .
CWR = WR + XR + YR + ZR CWI = WI + XI + YI + ZI	CXR = WR - XI - YR + ZI CXI = WI + XR - YI - ZR	CYR = WR - XR + YR - ZR CYI = WI - XI + YI - ZI	CZR = WR + XI - YR - ZI CZI = WI - XR - YI + ZR
. .	. .	. .	. .

Figure 88

2810

2632

C5

. .	. .	. .	. .
. .	. .	. .	. .
CWR = CWR - (WI +XI +YI +ZI) CWI = CWI +(WR +XR +YR +ZR)	CXR = CXR - (WI +XR -YI -ZR) CXI = CXI + (WR -XI -YR +ZI)	CYR = CYR -(WI -XI +YI -ZI) CYI = CYI +(WR -XR+YR-ZR)	CZR = CZR -(WI -XR -YI +ZR) CZI = CZI + (WR +XI -YR -ZI)
. .	. .	. .	. .

Figure 89

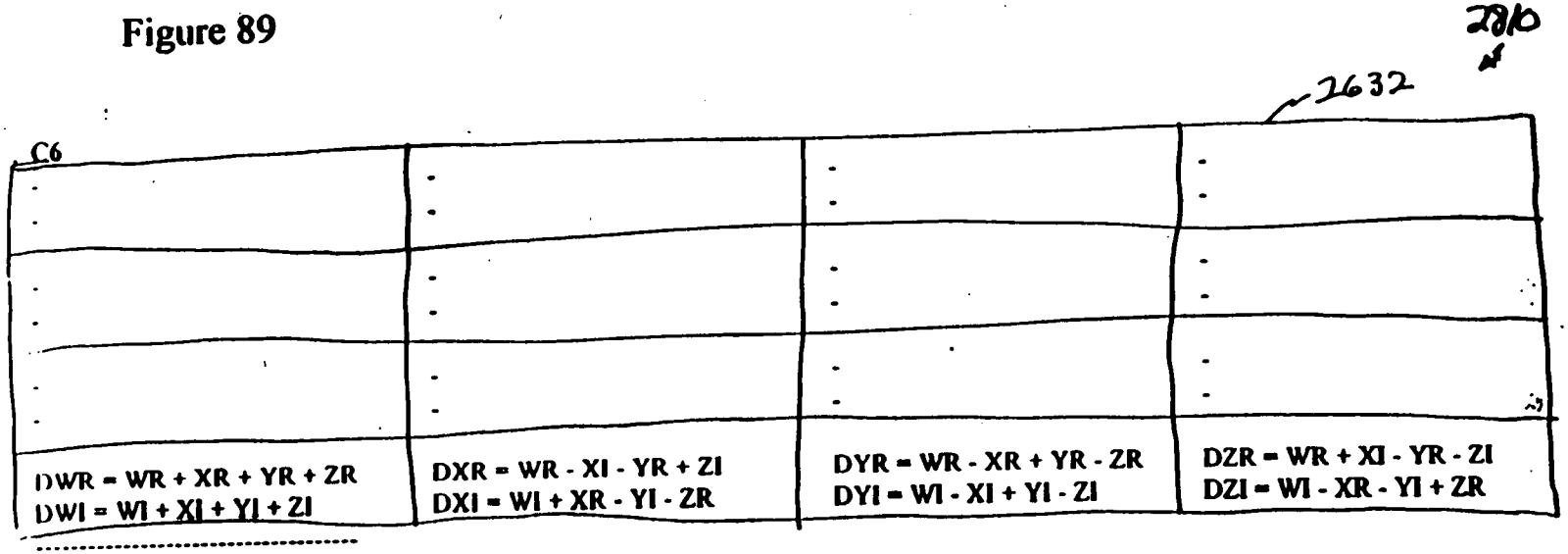
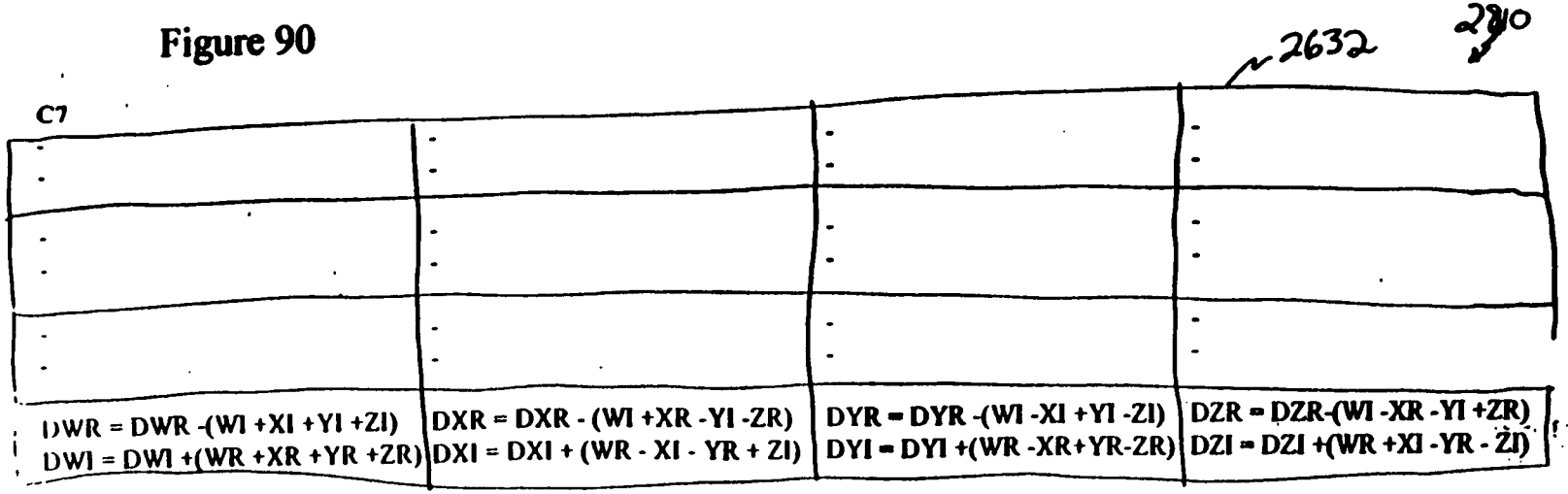


Figure 90



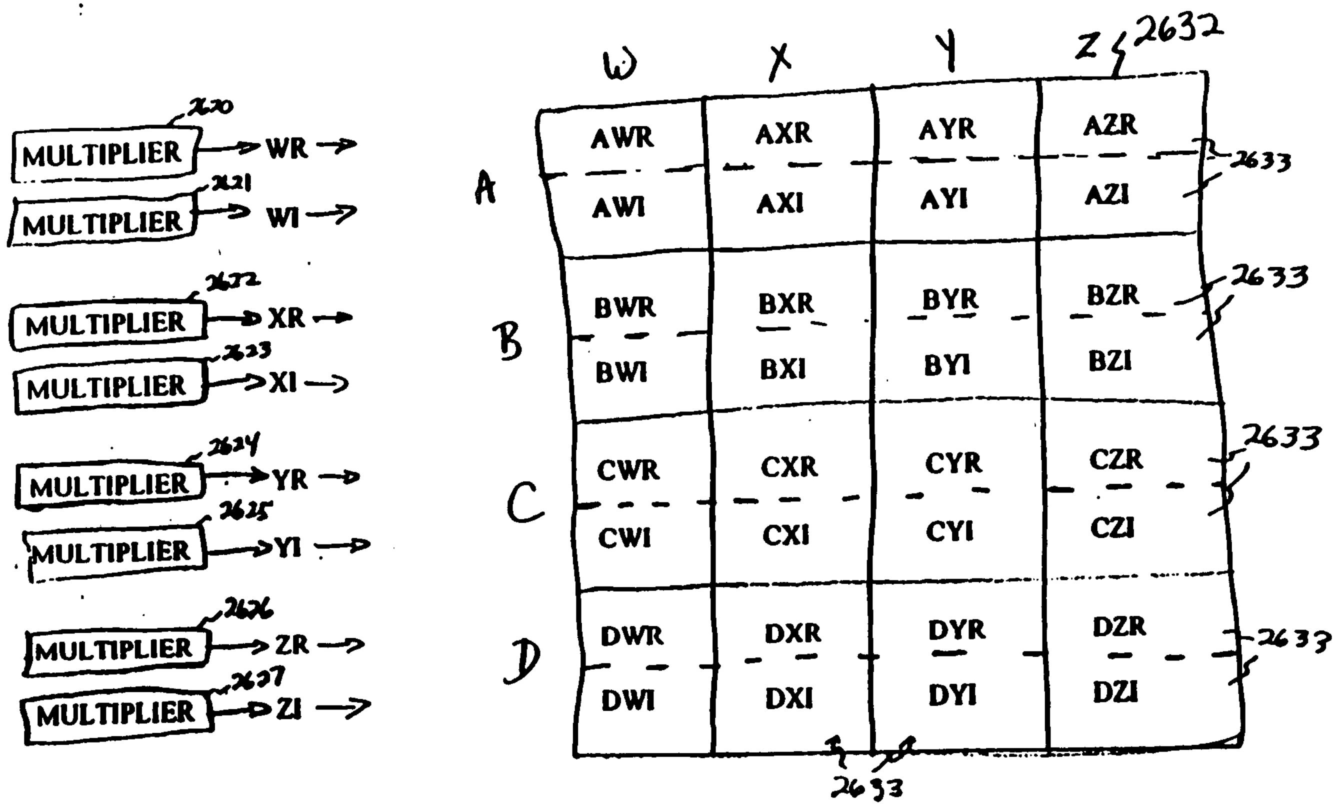

MULTIPLIER
2620
WR
MULTIPLIER
2621
WI
MULTIPLIER
2622
XR
MULTIPLIER
2623
XI
MULTIPLIER
2624
YR
MULTIPLIER
2625
YI
MULTIPLIER
2626
ZR
MULTIPLIER
2627
ZI
W
X
Y
Z
2632
A
B
C
D
AWR
AWI
AXR
AXI
AYR
AYI
AZR
AZI
BWR
BWI
BXR
BXI
BYR
BYI
BZR
BZI
CWR
CWI
CXR
CXI
CYR
CYI
CZR
CZI
DWR
DWI
DXR
DXI
DYR
DYI
DZR
DZI
2633

Figure 91

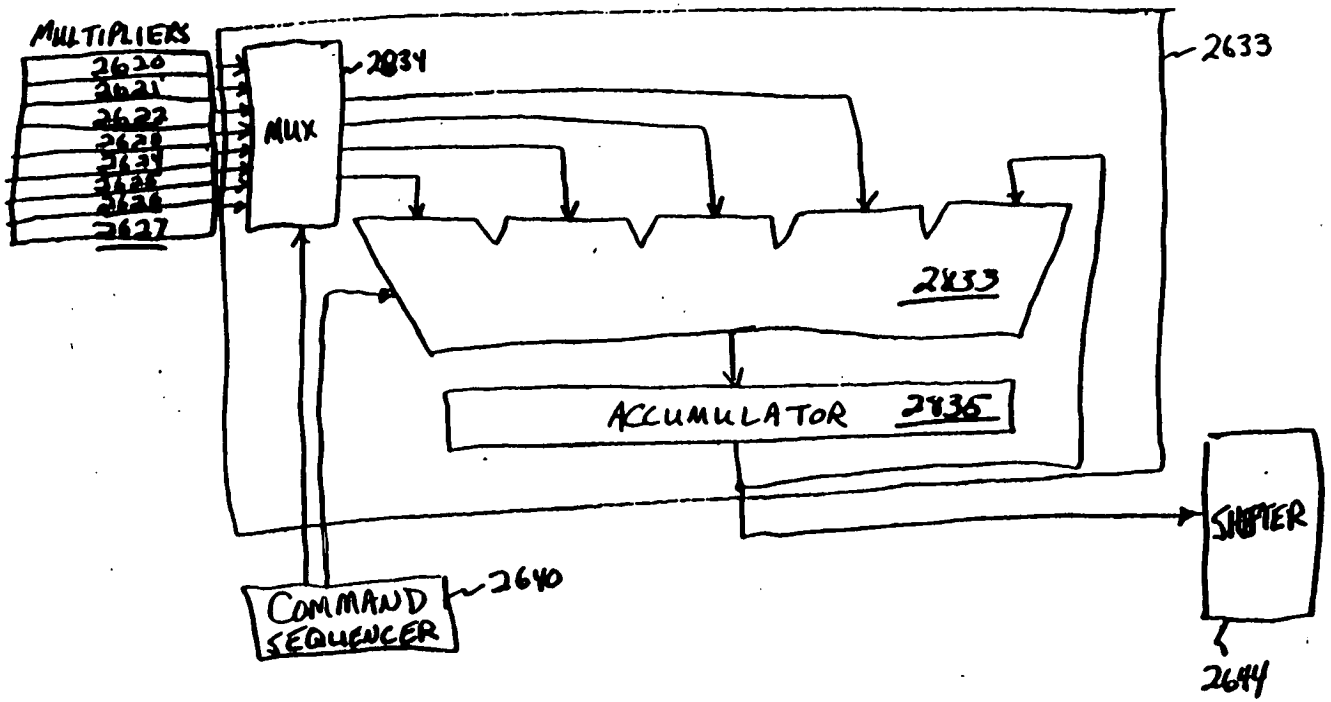

MULTIPLIERS
2630
2631
2632
2633
2634
2635
2636
2637
MUX
2634
2633
2633
ACCUMULATOR 2836
SHIFTER
COMMAND SEQUENCER
2640
2644

Figure 92

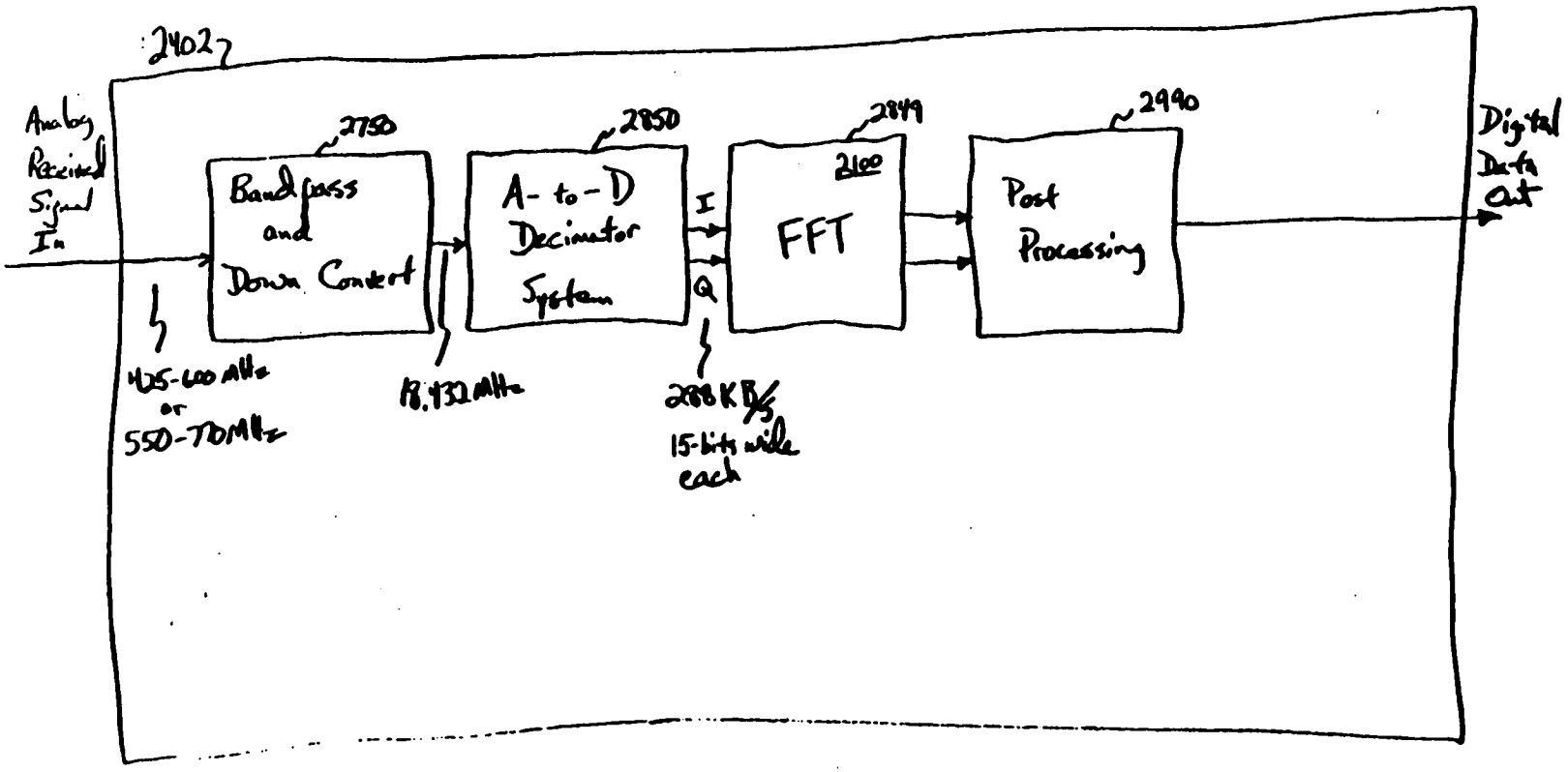
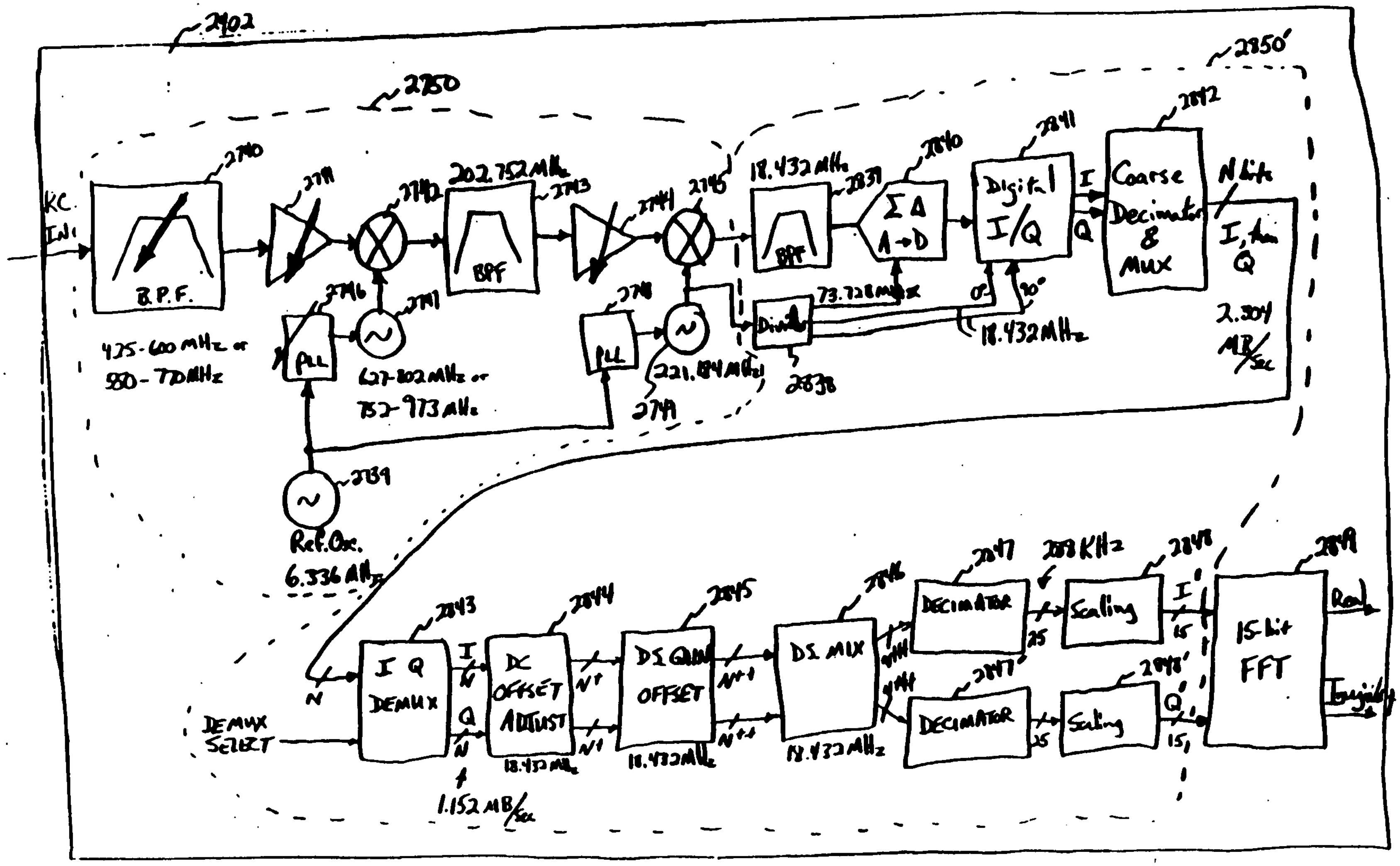


Figure 93



2902
2850
2850'
B.P.F.
425-600 MHz or
550-770 MHz
PLL
627-802 MHz or
752-973 MHz
202.752 MHz
BPF
PLL
221.184 MHz
18.432 MHz
BPF
Σ Δ
A→D
73.728 MHz
Divider
Digital
I/Q
18.432 MHz
Coarse
Decimator
&
MUX
N bits
2.304
MB/sec
Ref. Osc.
6.536 MHz
I Q
DEMUX
DEMUX
SELECT
DC
OFFSET
ADJUST
18.432 MHz
1.152 MB/sec
DS QAM
OFFSET
18.432 MHz
DS MIX
18.432 MHz
DECIMATOR
DECIMATOR
288 KHz
Scaling
Scaling
15-bit
FFT
Real
Imaginary

Figure 94

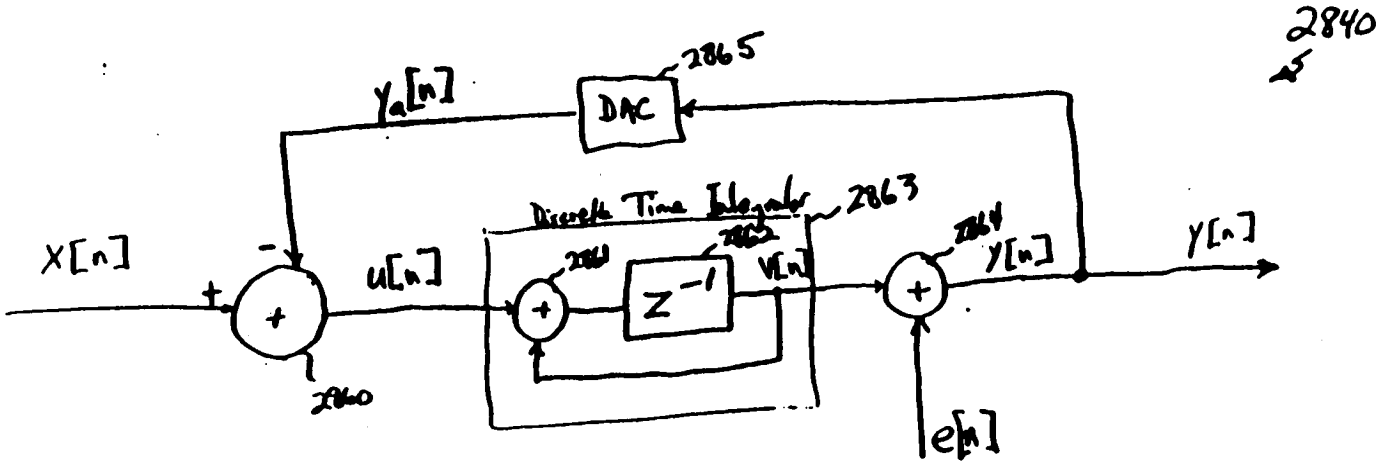

2840
2865
DAC
$y_a[n]$
Discrete Time Integrator
2863
X[n]
u[n]
2861
2862
z^{-1}
V[n]
2864
y[n]
Y[n]
2860
e[n]

Figure 95

Figure 96

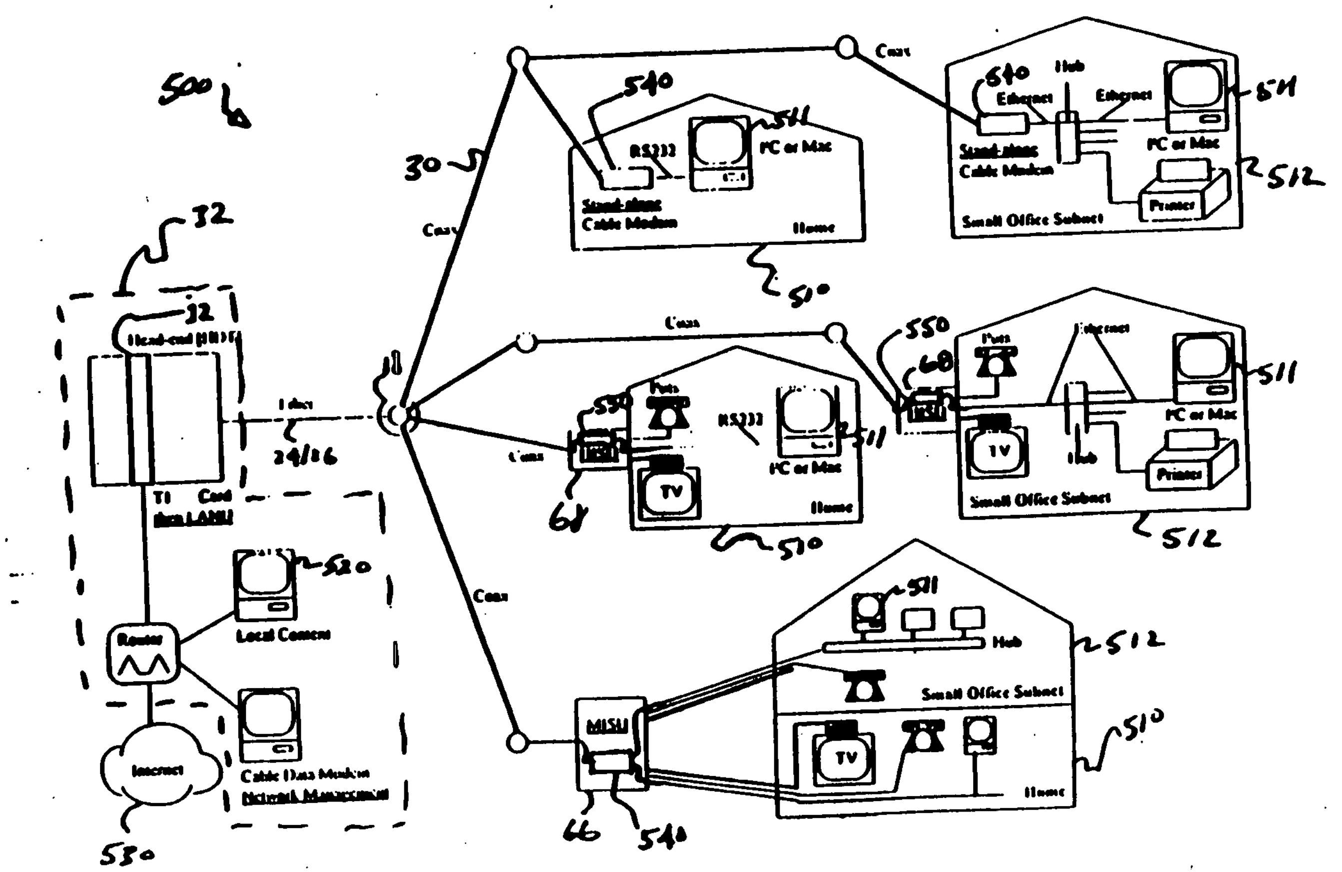
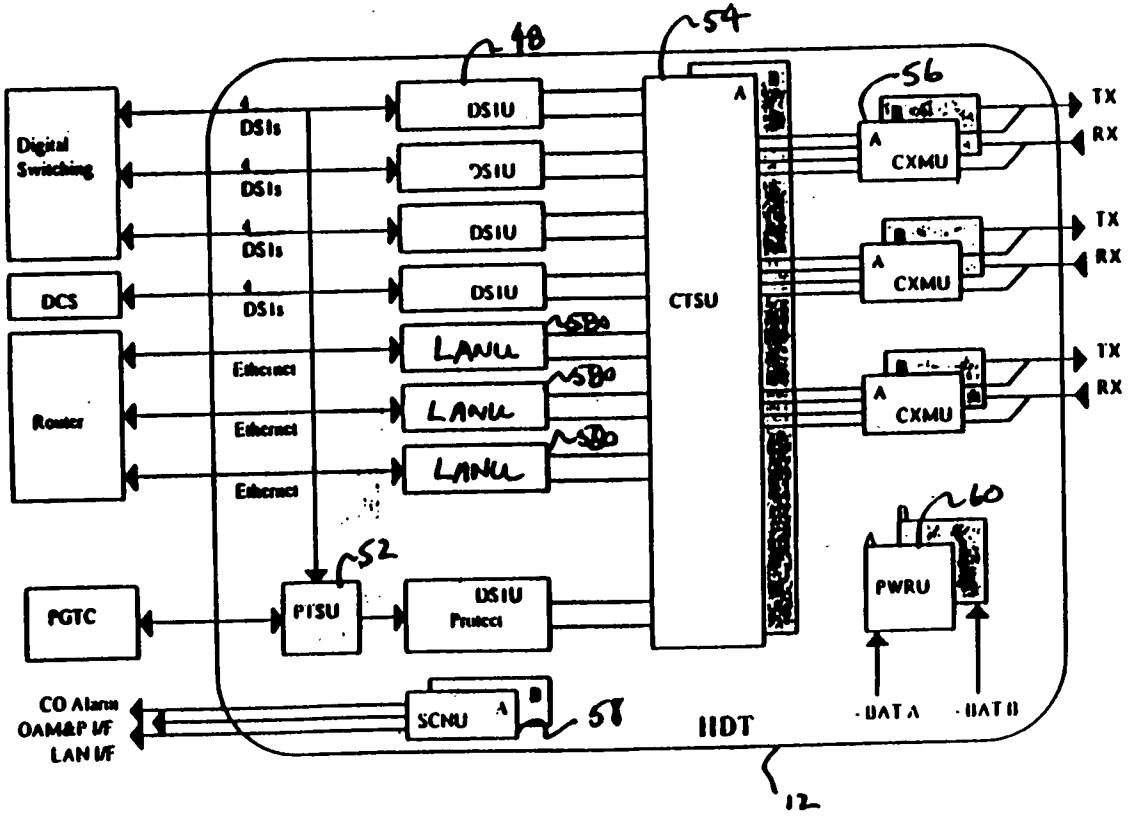
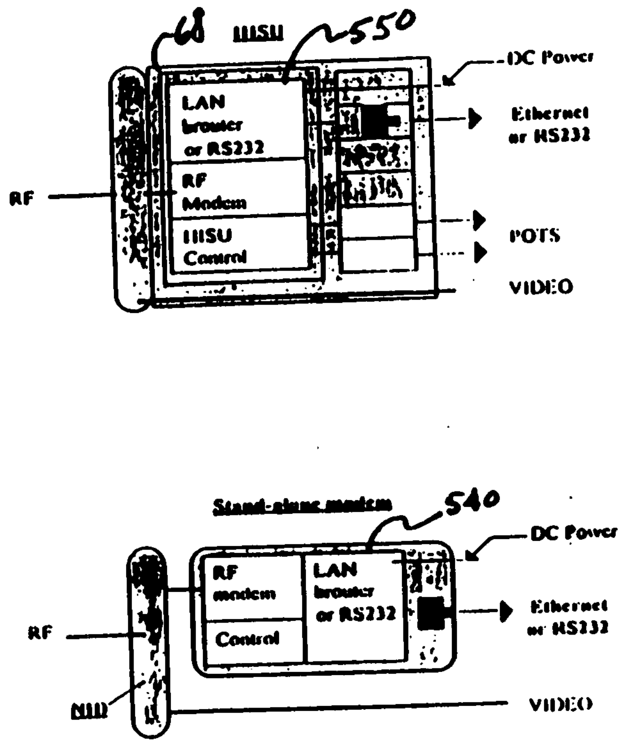

500
32
32
Head-end (HDT)
T1 Card
(from LAMU)
24/26
30
Coax
Router
Local Content
520
Internet
530
Cable Data Modem
Network Management
540
RS232
PC or Mac
511
Stand-alone
Cable Modem
Home
510
Hub
Ethernet
Printer
Small Office Subnet
512
550
68
Pots
TV
MISU
66

Figure 97


Digital Switching
DCS
Router
PGTC
CO Alarm
OAM&P I/F
LAN I/F
DS1s
DS1s
DS1s
DS1s
Ethernet
Ethernet
Ethernet
DS1U
DS1U
DS1U
DS1U
LANU
LANU
LANU
PTSU
DS1U
Protect
SCNU
CTSU
CXMU
CXMU
CXMU
TX
RX
TX
RX
TX
RX
PWRU
-DATA
-DATB
HDT
48
54
56
52
58
60
12



68
HSU
550
DC Power
LAN
brouter
or RS232
Ethernet
or RS232
RF
RF
Modem
HSU
Control
POTS
VIDEO
Stand-alone modem
540
DC Power
RF
modem
Control
LAN
brouter
or RS232
Ethernet
or RS232
RF
NID
VIDEO

Figure 98

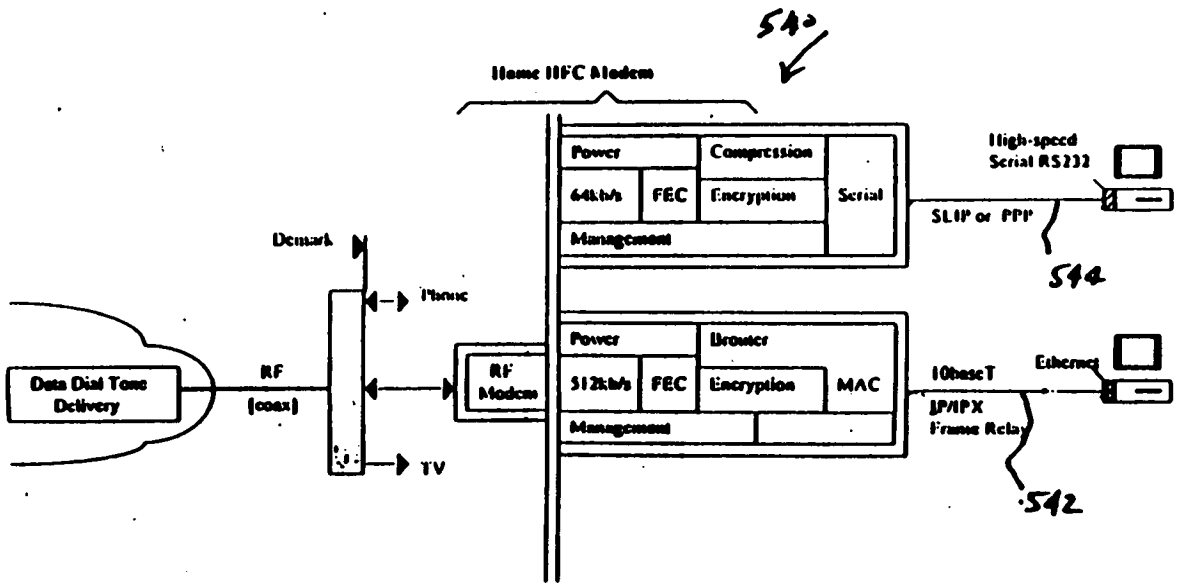

542
Home HFC Modem
Power
Compression
64kb/s
FEC
Encryption
Serial
Management
High-speed
Serial RS232
SLIP or PPP
544
Demark
Phone
Data Dial Tone
Delivery
RF
(coax)
RF
Modem
Power
Bronter
512kb/s
FEC
Encryption
MAC
Management
10baseT
Ethernet
IP/IPX
Frame Relay
542
TV

Figure 99

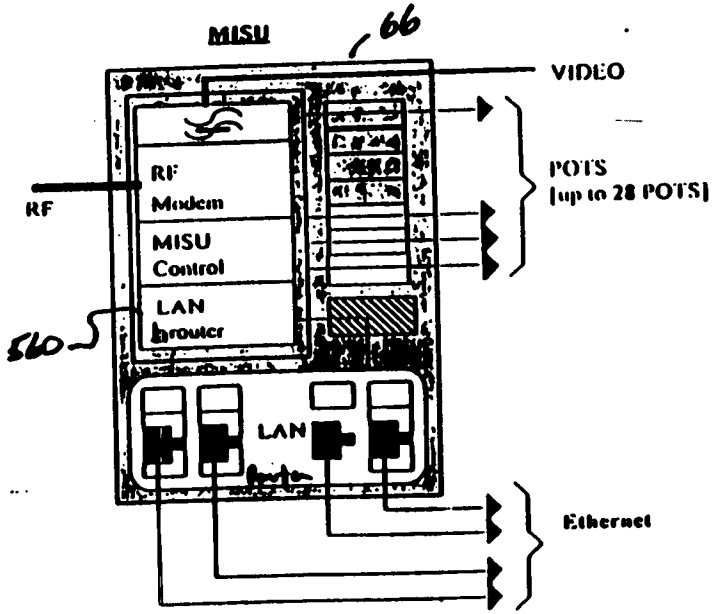

MISU
66
VIDEO
POTS
(up to 28 POTS)
RF
RF
Modem
MISU
Control
LAN
Router
560
LAN
Ethernet

Figure 100

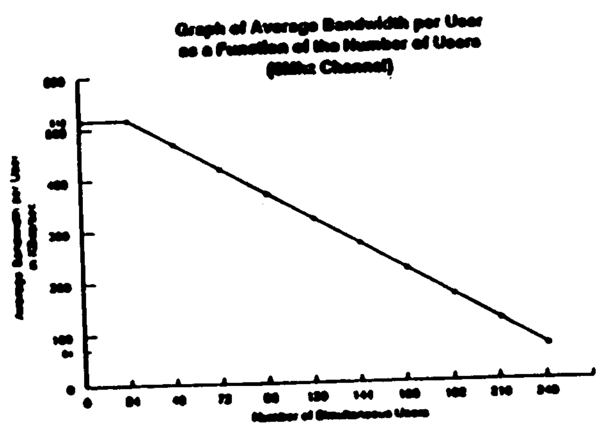

Graph of Average Bandwidth per User
as a Function of the Number of Users
(6Mhz Channel)
600
400
300
200
100
0
0
24
48
72
96
120
144
168
192
216
240
Number of Simultaneous Users

Figure 101

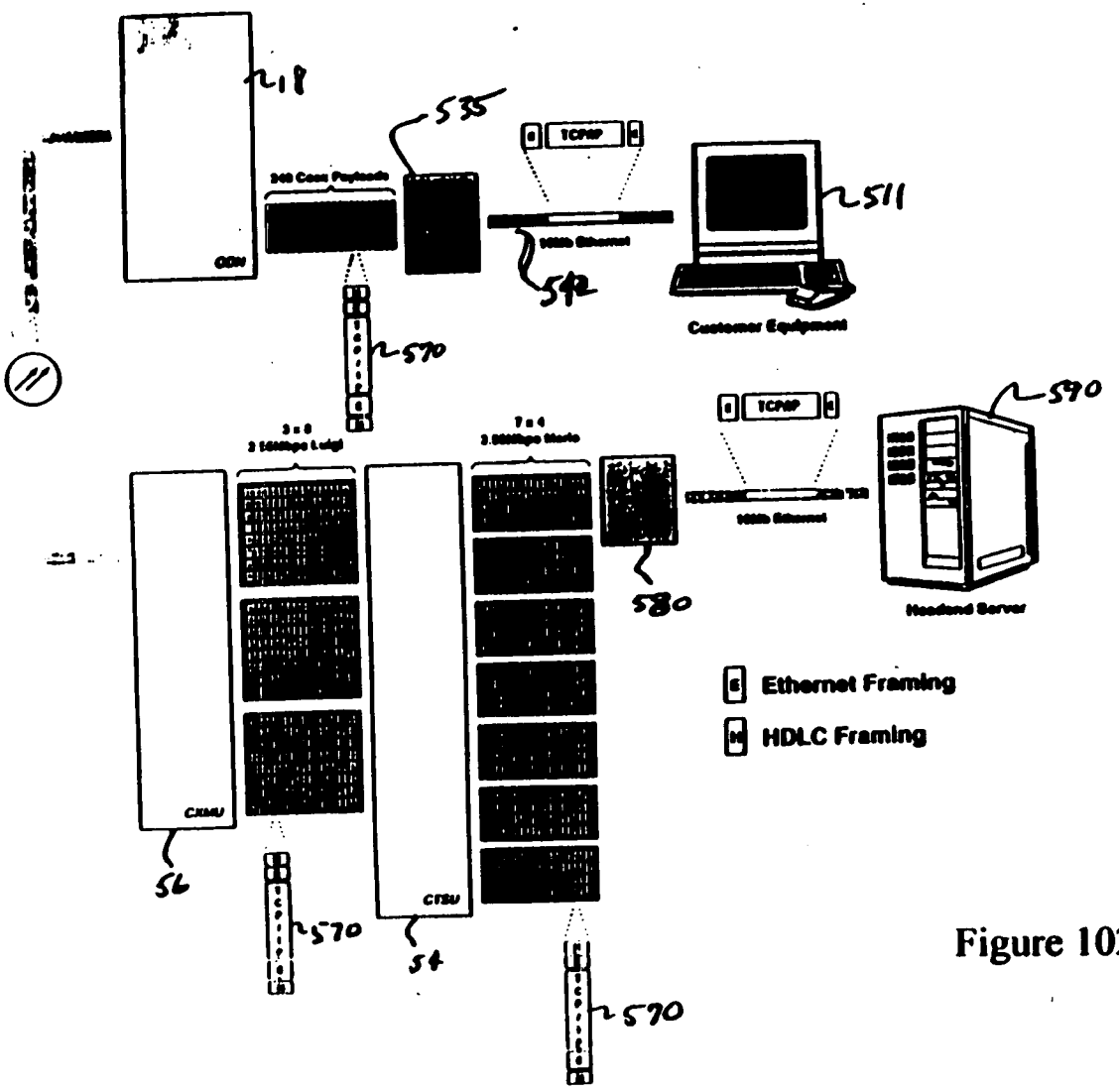


Figure 102

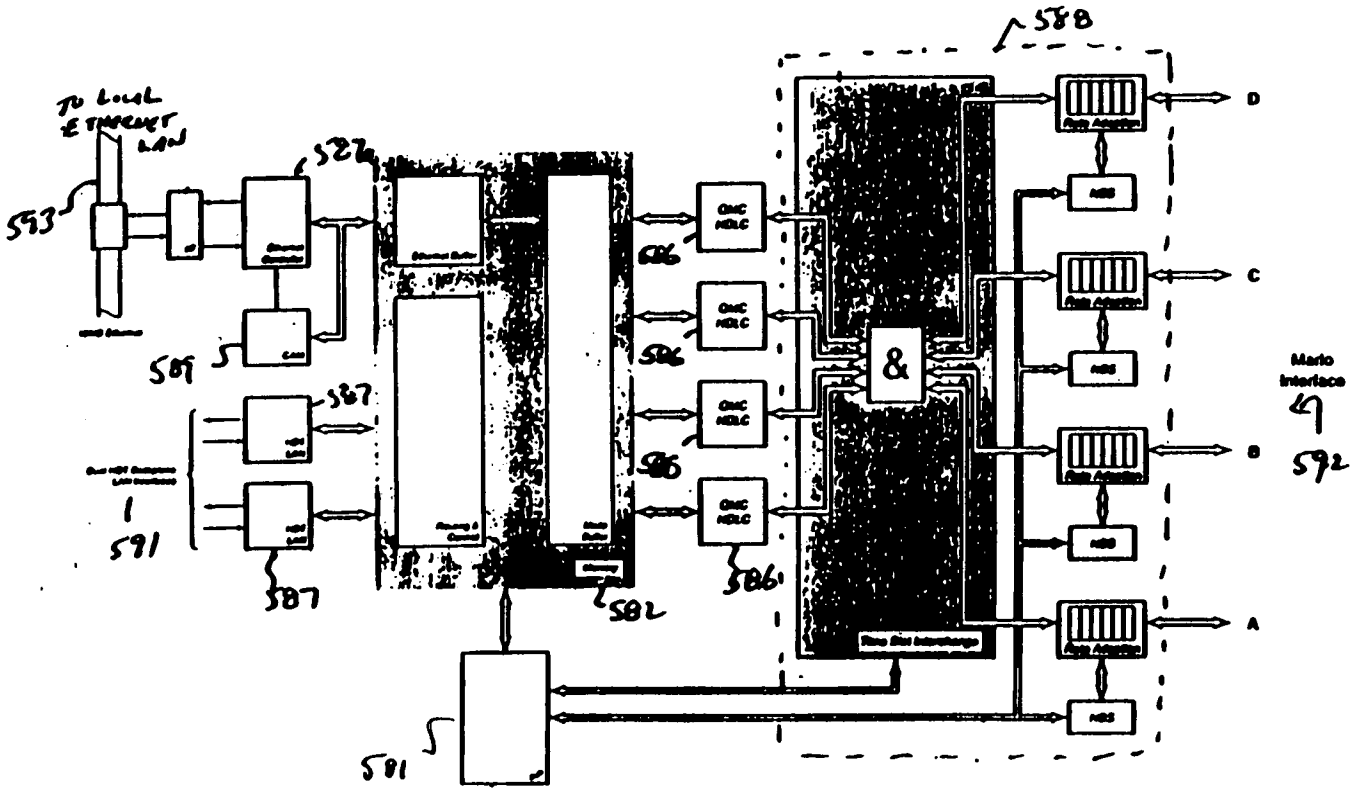


Figure 103

580

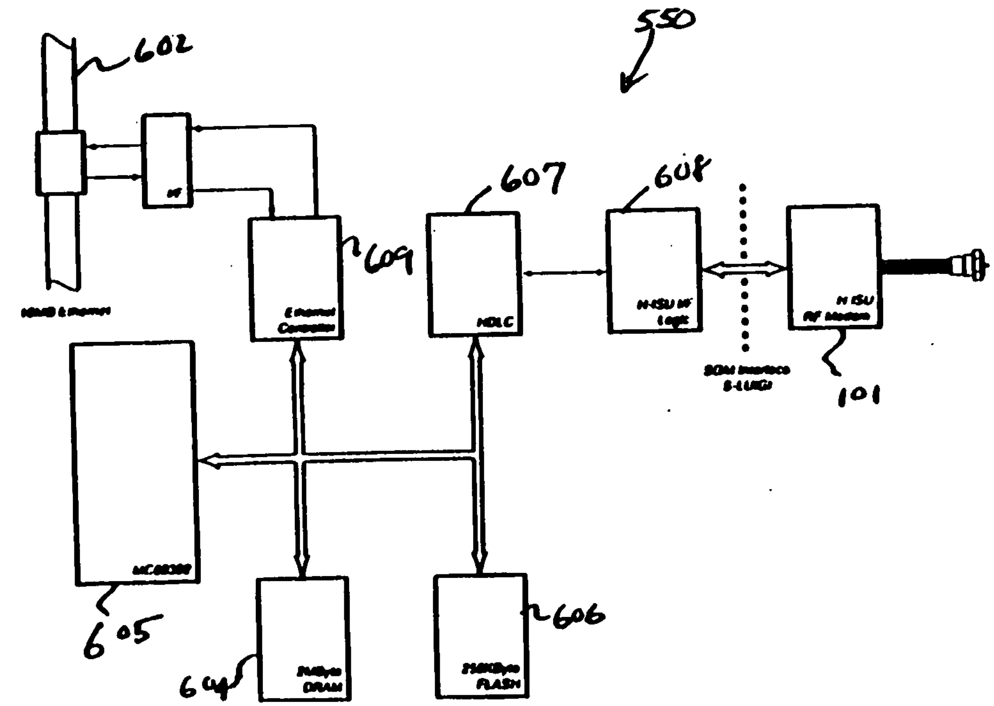


Figure 104

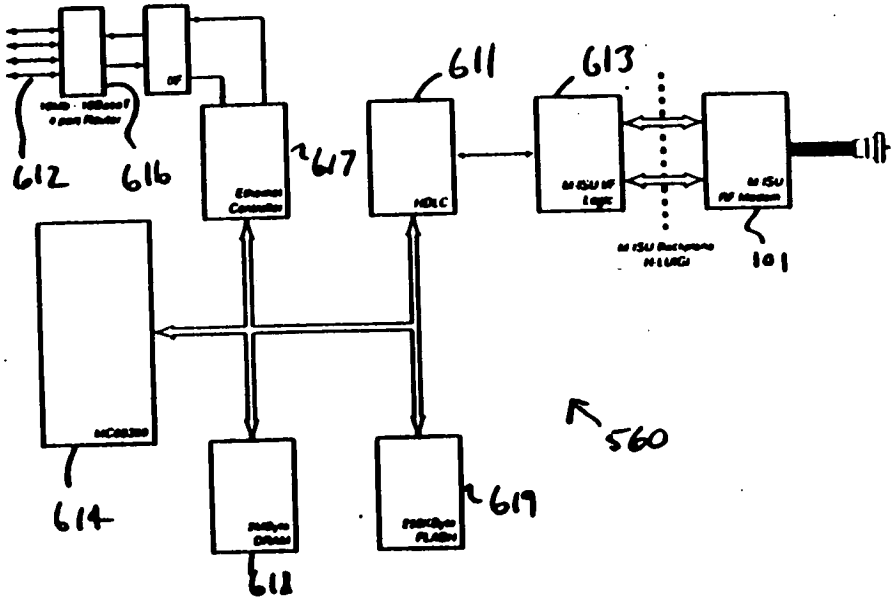


Figure 105

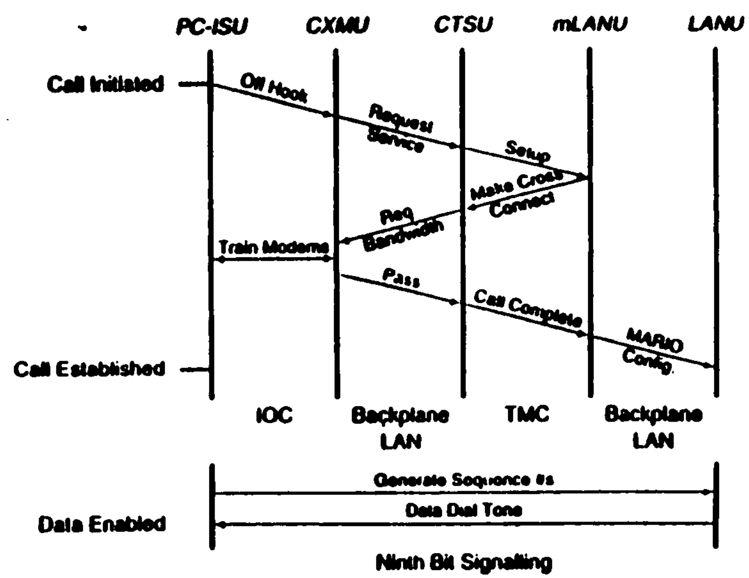

PC-ISU
CXMU
CTSU
mLANU
LANU
Call Initiated
Off Hook
Request Service
Setup
Make Cross Connect
Req Bandwidth
Train Modems
Pass
Call Complete
MARIO Config
Call Established
IOC
Backplane LAN
TMC
Backplane LAN
Generate Sequence #s
Data Dial Tone
Data Enabled
Ninth Bit Signalling

Figure 106

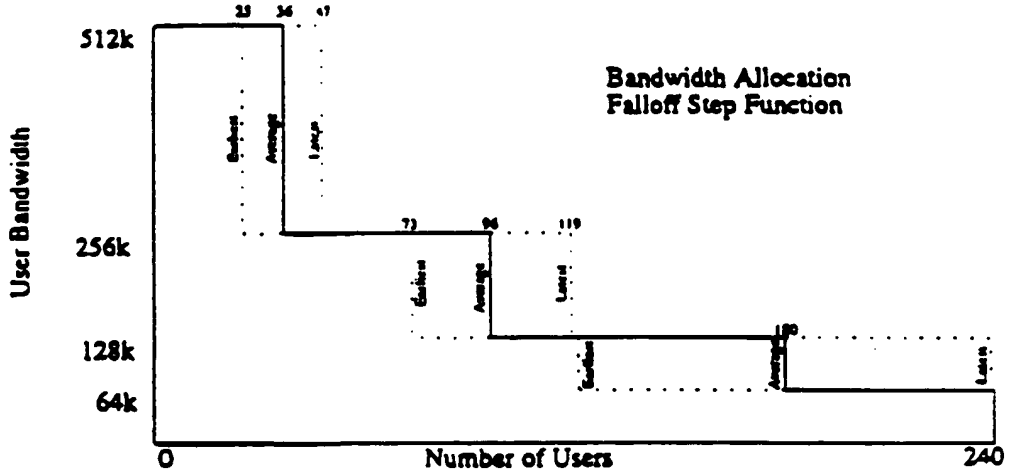


Figure 107

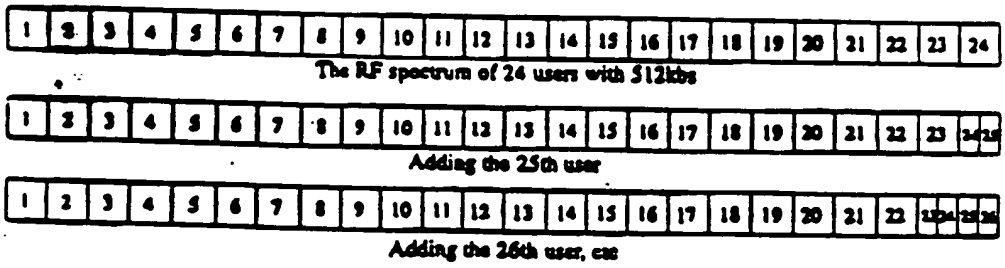


Figure 108

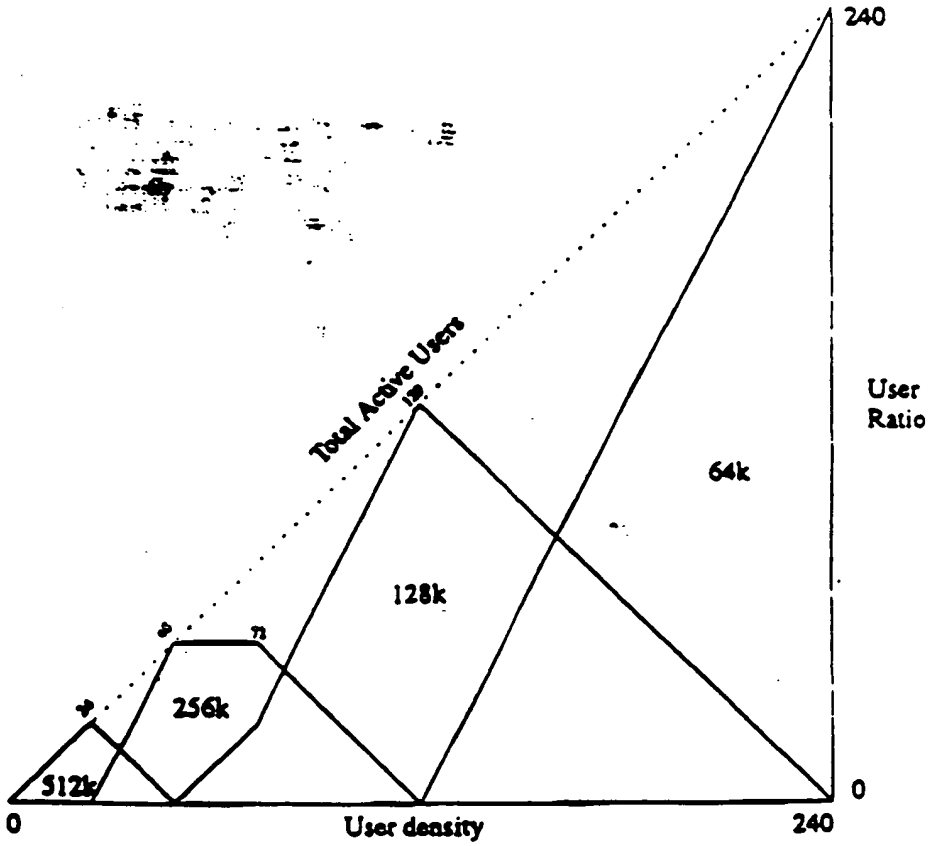

240
Total Active Users
User
Ratio
64k
128k
256k
512k
0
0
User density
240

Figure 109

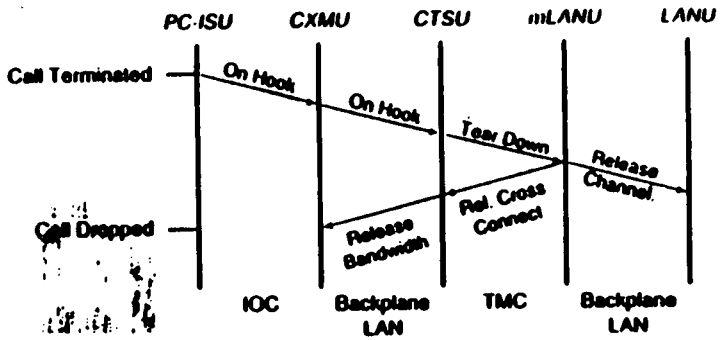
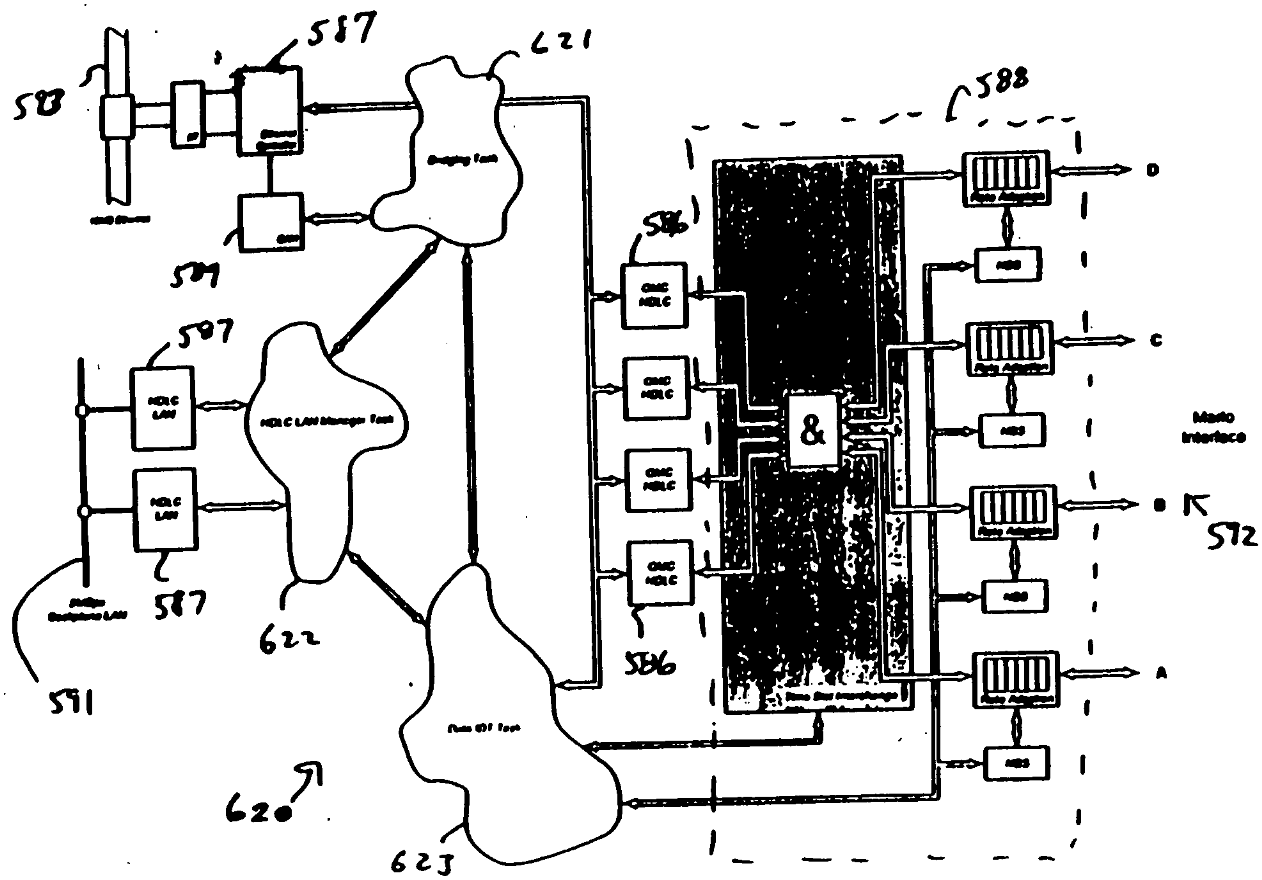


Figure 110



587
621
588
583
589
586
D
C
B
A
Radio
Interface
572
587
587
622
586
591
623
620

Figure 111

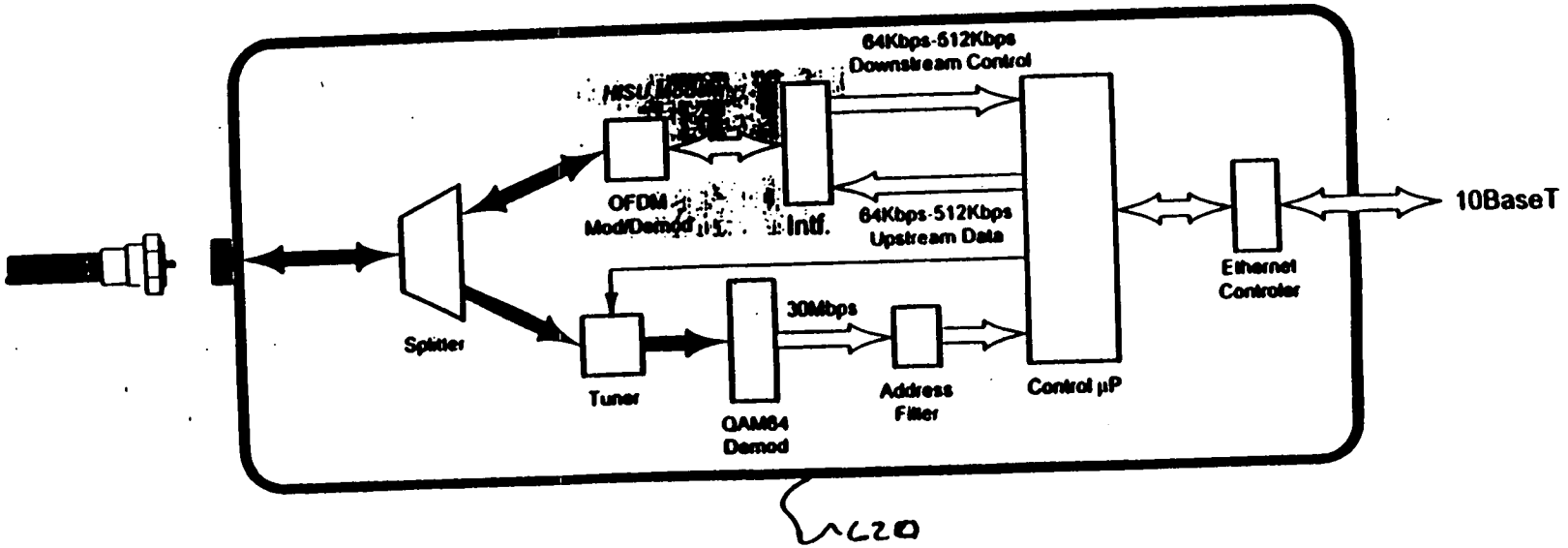

64Kbps-512Kbps
Downstream Control
OFDM
Mod/Demod
Intf.
64Kbps-512Kbps
Upstream Data
10BaseT
Ethernet
Controler
Splitter
Tuner
30Mbps
QAM64
Demod
Address
Filter
Control µP
120

Figure 112

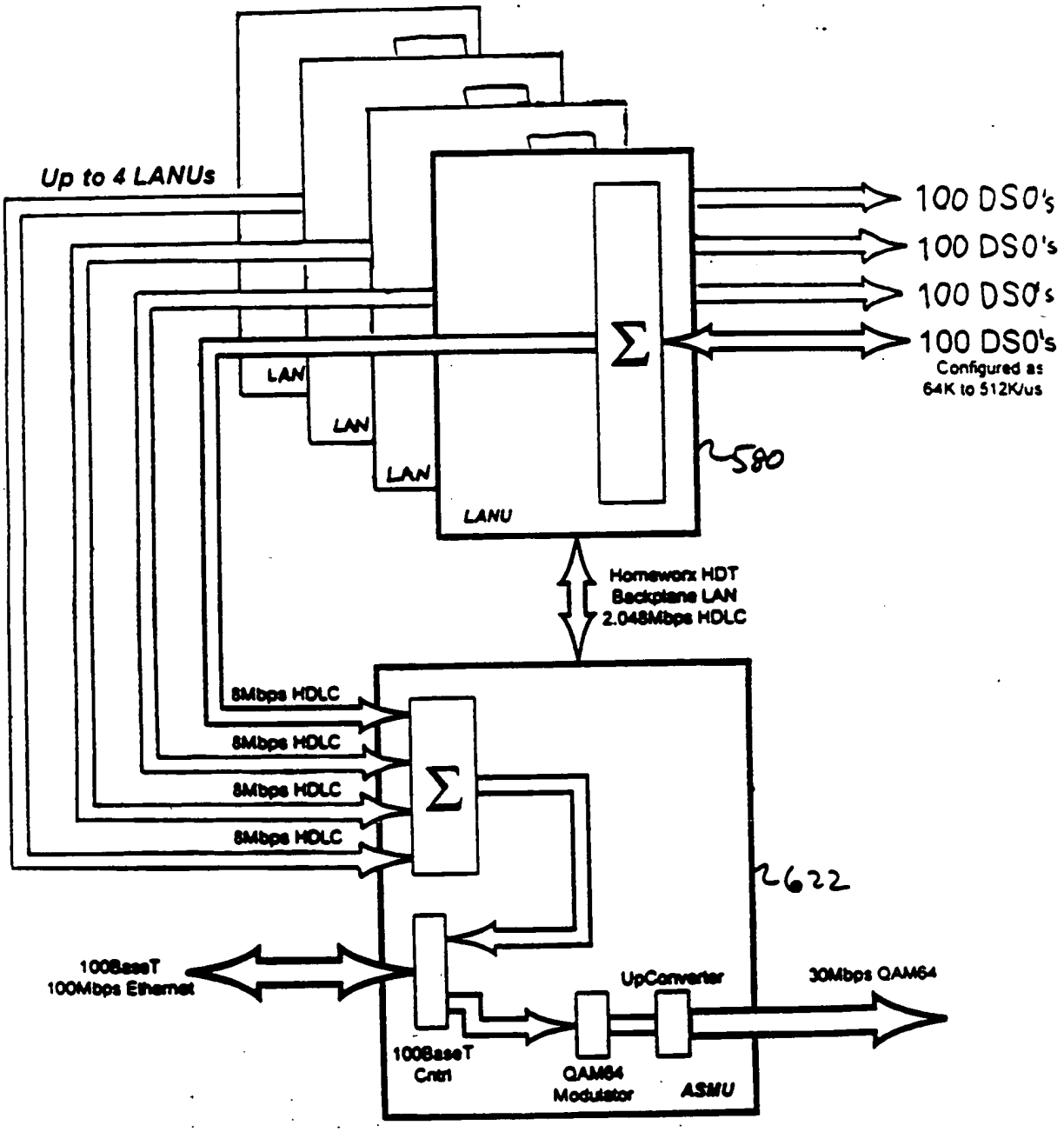

Up to 4 LANUs
100 DS0's
100 DS0's
100 DS0's
100 DS0's
Configured as
64K to 512K/us
LAN
LAN
LAN
LANU
580
Homeworx HDT
Backplane LAN
2.048Mbps HDLC
8Mbps HDLC
8Mbps HDLC
8Mbps HDLC
8Mbps HDLC
622
100BaseT
100Mbps Ethernet
UpConverter
30Mbps QAM64
100BaseT
Cntrl
QAM64
Modulator
ASMU

Figure 113

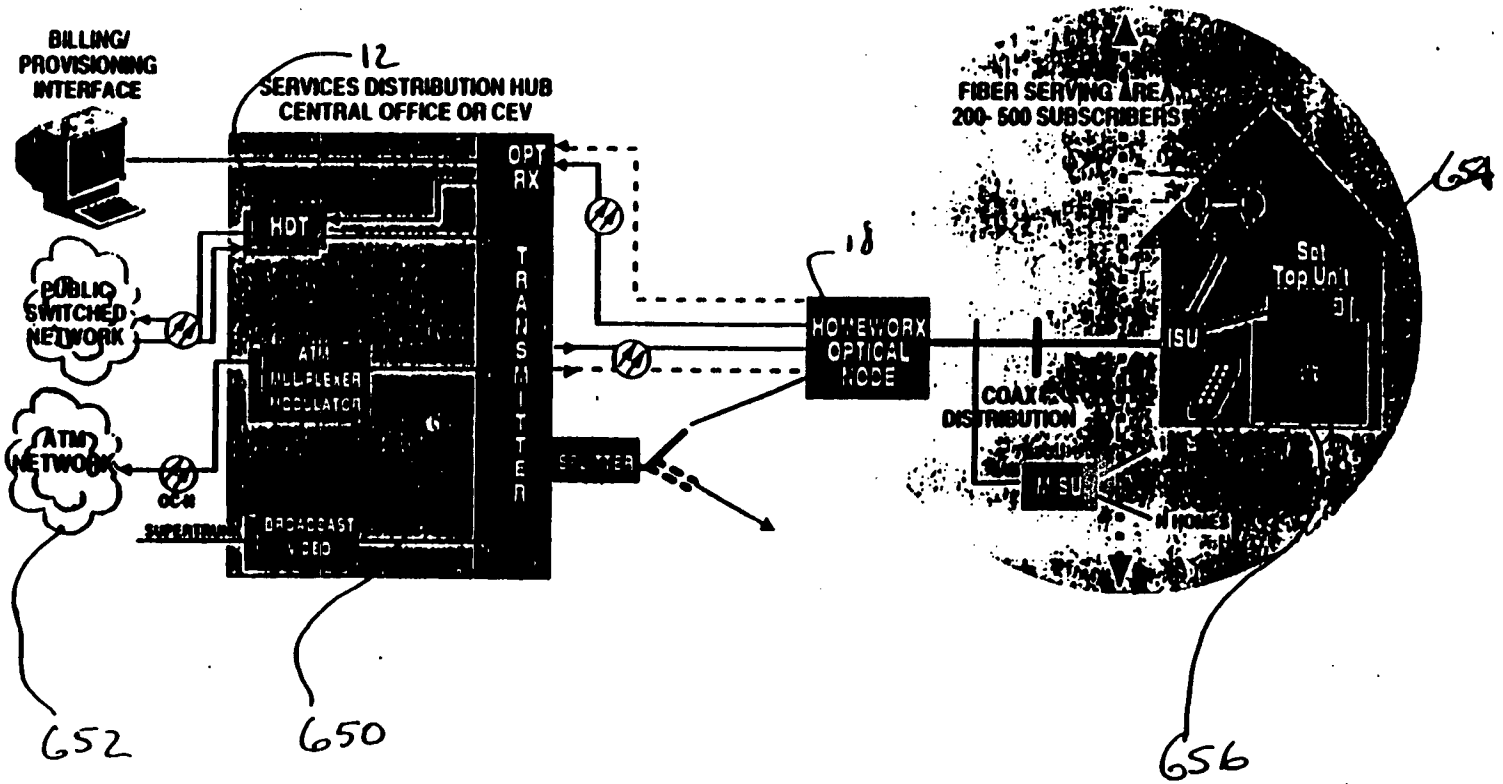


Figure 114

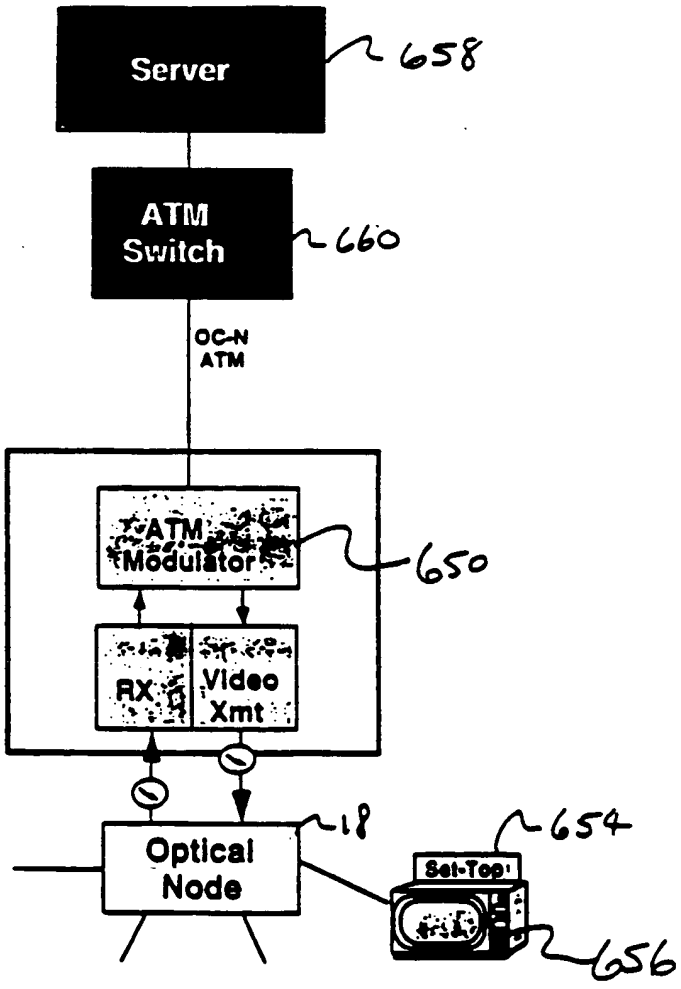
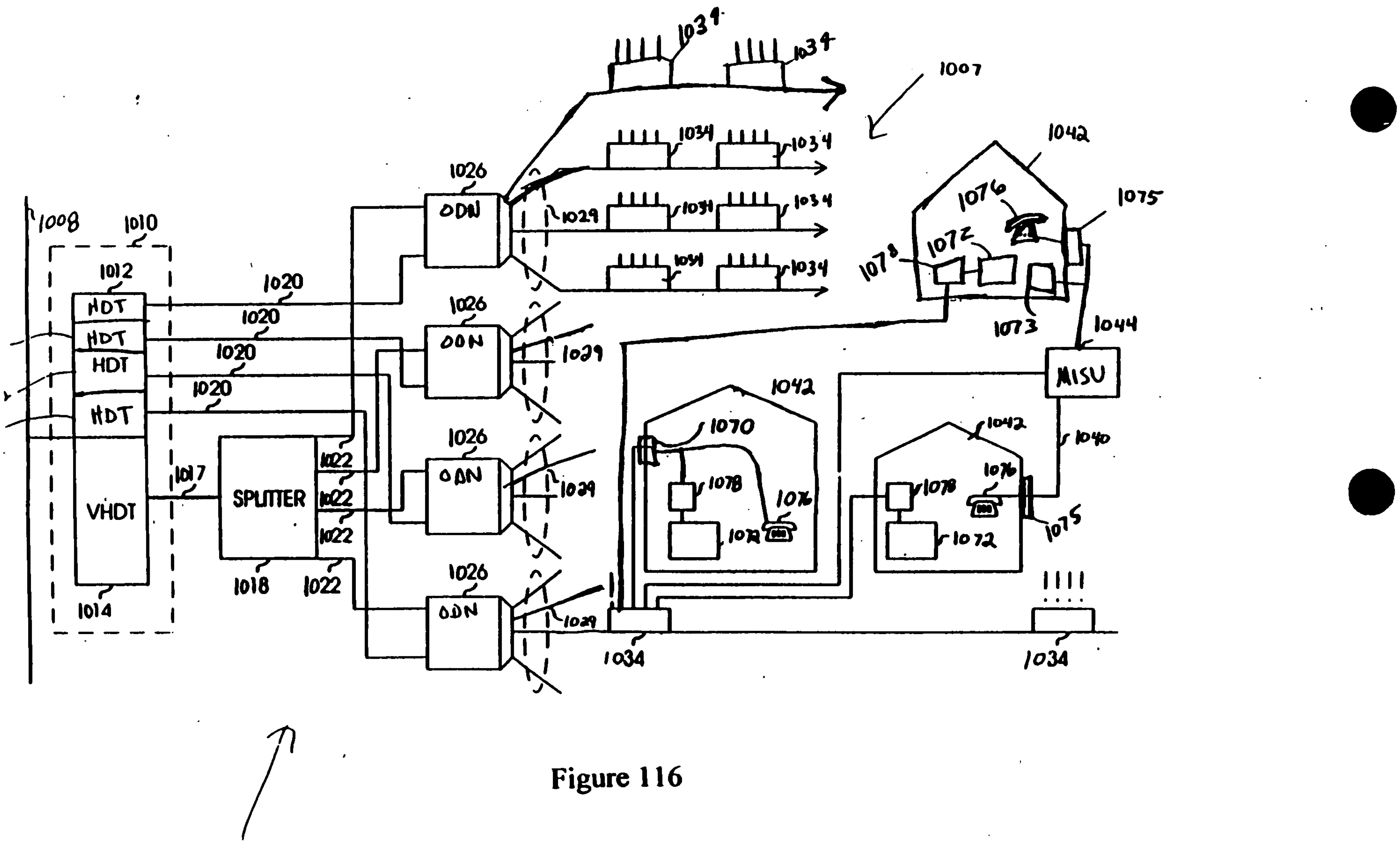
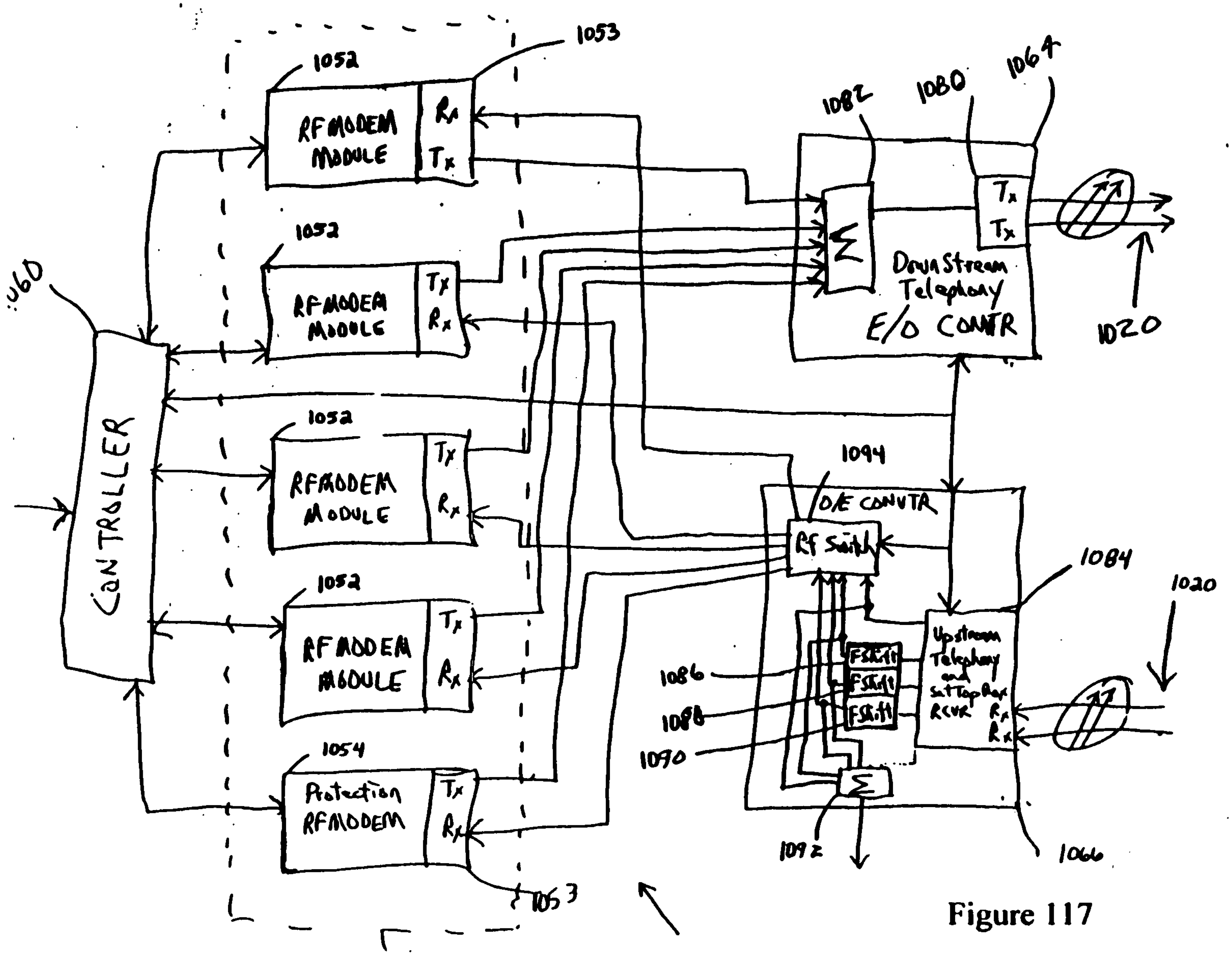

Server
658
ATM Switch
660
OC-N ATM
ATM Modulator
650
RX
Video Xmt
18
Optical Node
654
Set-Top
656

Figure 115



1008
1010
1012
HDT
HDT
HDT
HDT
VHDT
1014
1020
1020
1020
1020
1017
SPLITTER
1018
1022
1022
1022
1022
1026
ODN
ODN
ODN
ODN
1029
1034
1007
1042
1076
1075
1072
1078
1073
1044
MISU
1040
1070

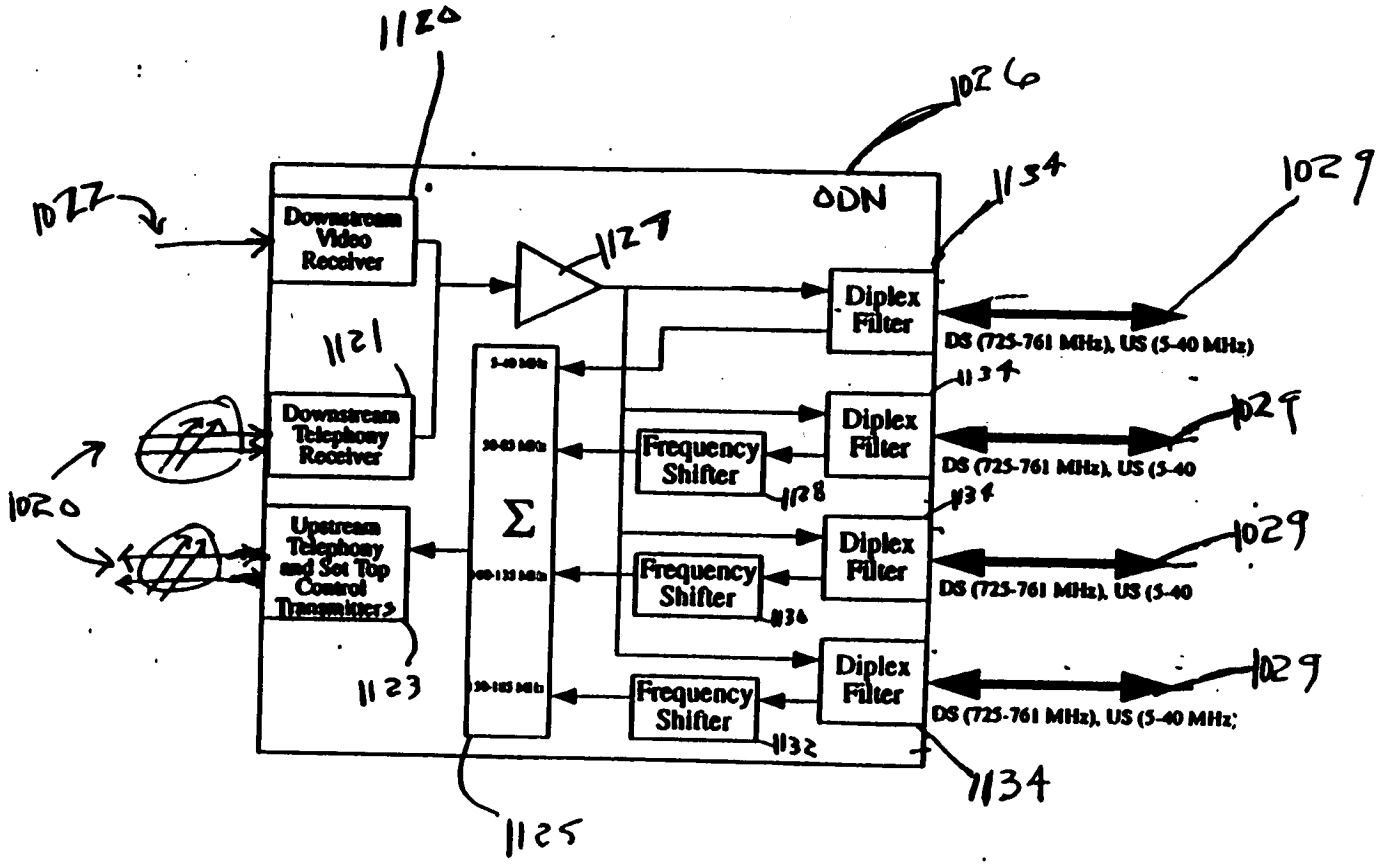
Figure 116



1053
1052
RF MODEM MODULE
Rx
Tx
1052
RF MODEM MODULE
Tx
Rx
1052
RF MODEM MODULE
Tx
Rx
1052
RF MODEM MODULE
Tx
Rx
1054
Protection RF MODEM
Tx
Rx
1053
1060
CONTROLLER
1082
1080
1064
Σ
Tx
Tx
DownStream Telephony E/O CONVTR
1020
1094
O/E CONVTR
RF Switch
1084
1020
1086
1088
1090
F Shift
F Shift
F Shift
Upstream Telephony and Set Top Box RCVR
Rx
Rx
Σ
1092
1066

Figure 117

Figure 118


1120
1026
1127
1122
ODN
1134
1029
Downstream Video Receiver
1121
Diplex Filter
DS (725-761 MHz), US (5-40 MHz)
Downstream Telephony Receiver
Frequency Shifter
1128
1020
Upstream Telephony and Set Top Control Transmitters
Σ
1123
1125
1132
1134

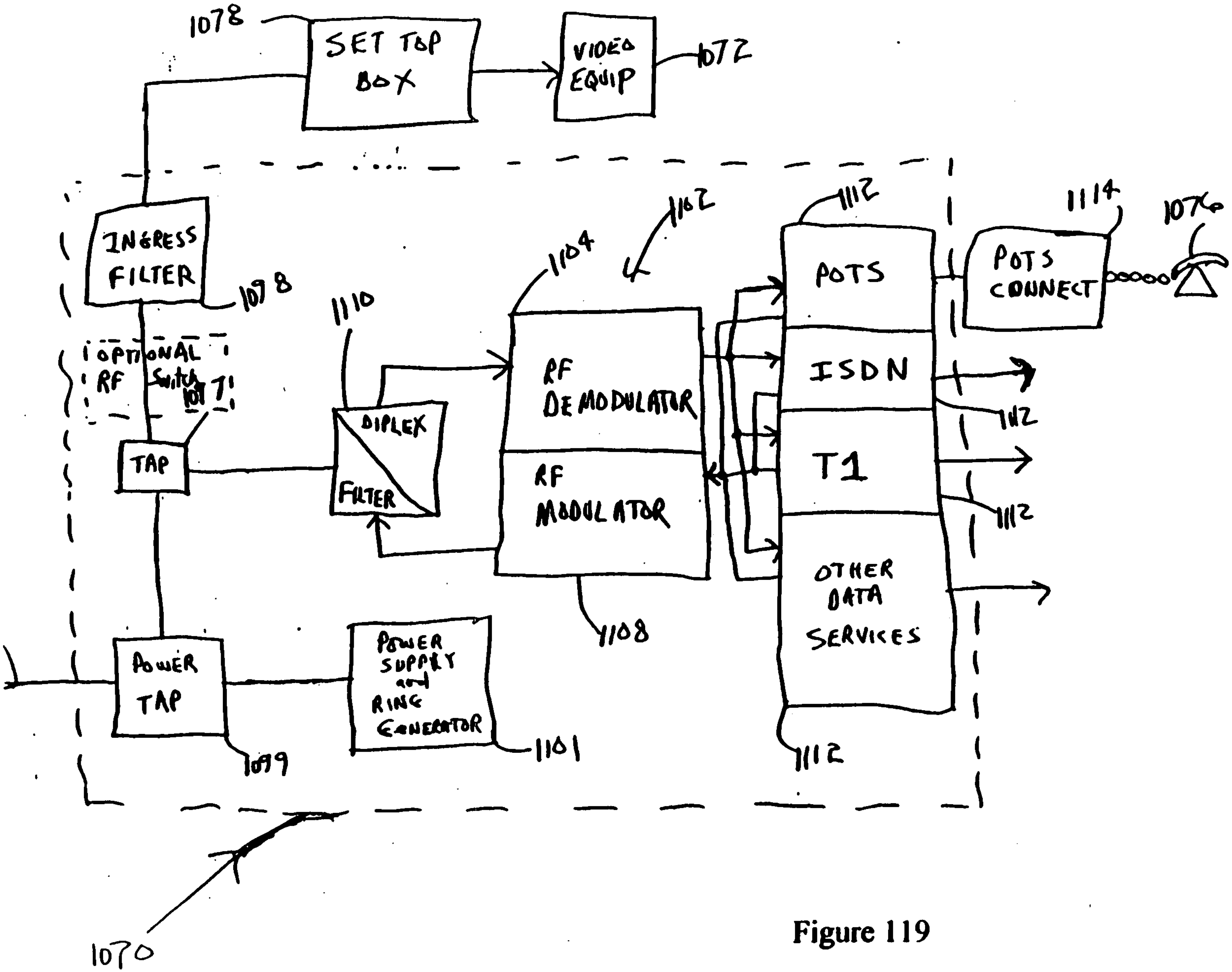

1078
SET TOP BOX
VIDEO EQUIP
1072
INGRESS FILTER
1078
OPTIONAL RF Switch
1071
TAP
1110
DIPLEX FILTER
1104
1102
RF DEMODULATOR
RF MODULATOR
1108
1112
POTS
ISDN
T1
OTHER DATA SERVICES
1112
1112
1112
1114
POTS CONNECT
1076
POWER TAP
1099
POWER SUPPLY and RING GENERATOR
1101
1070

Figure 119

Figure 120

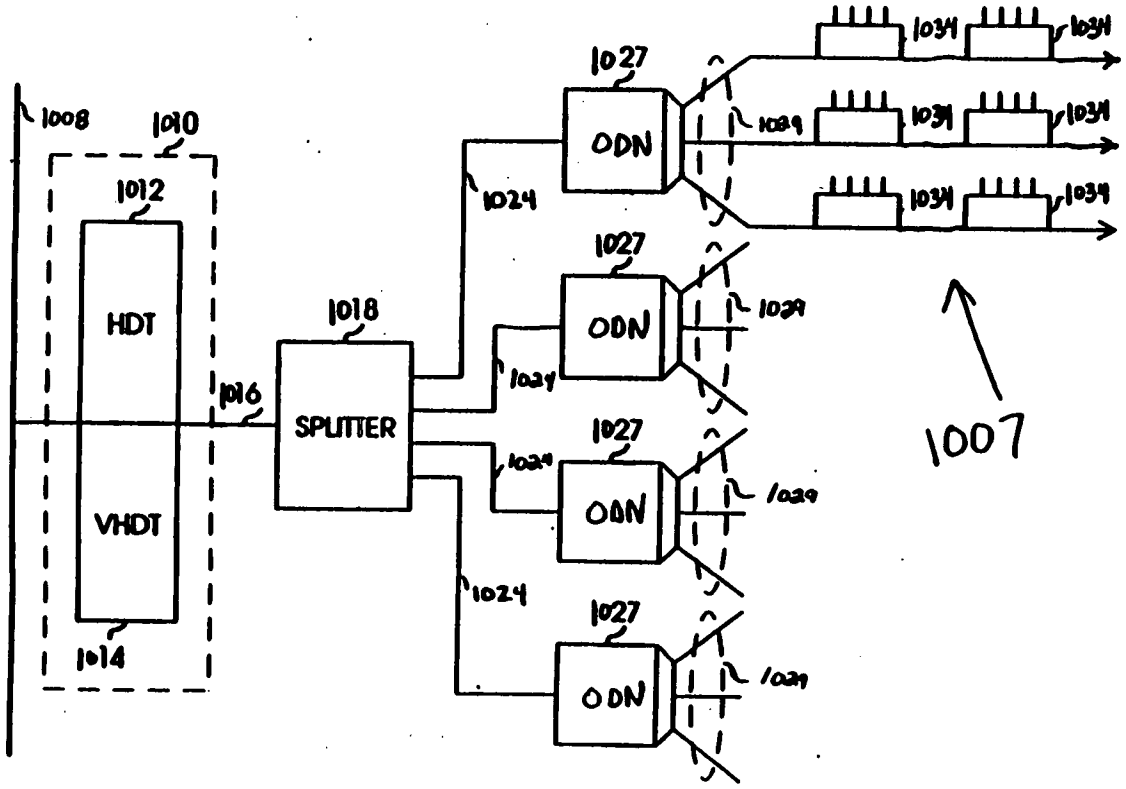

1008
1010
1012
HDT
VHDT
1014
1016
1018
SPLITTER
1024
1027
ODN
1029
1031
1007

Figure 121

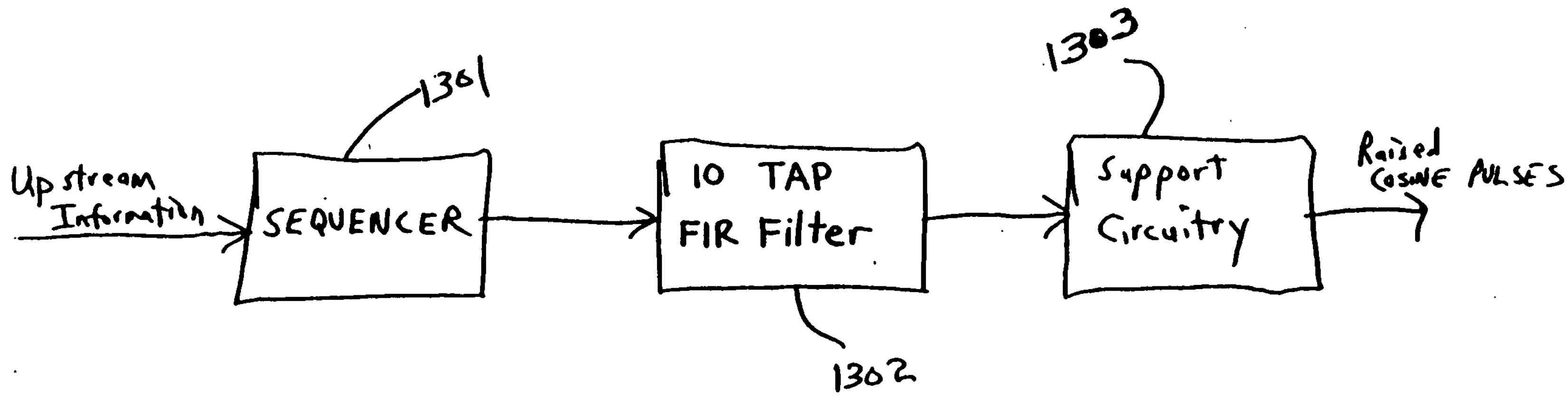
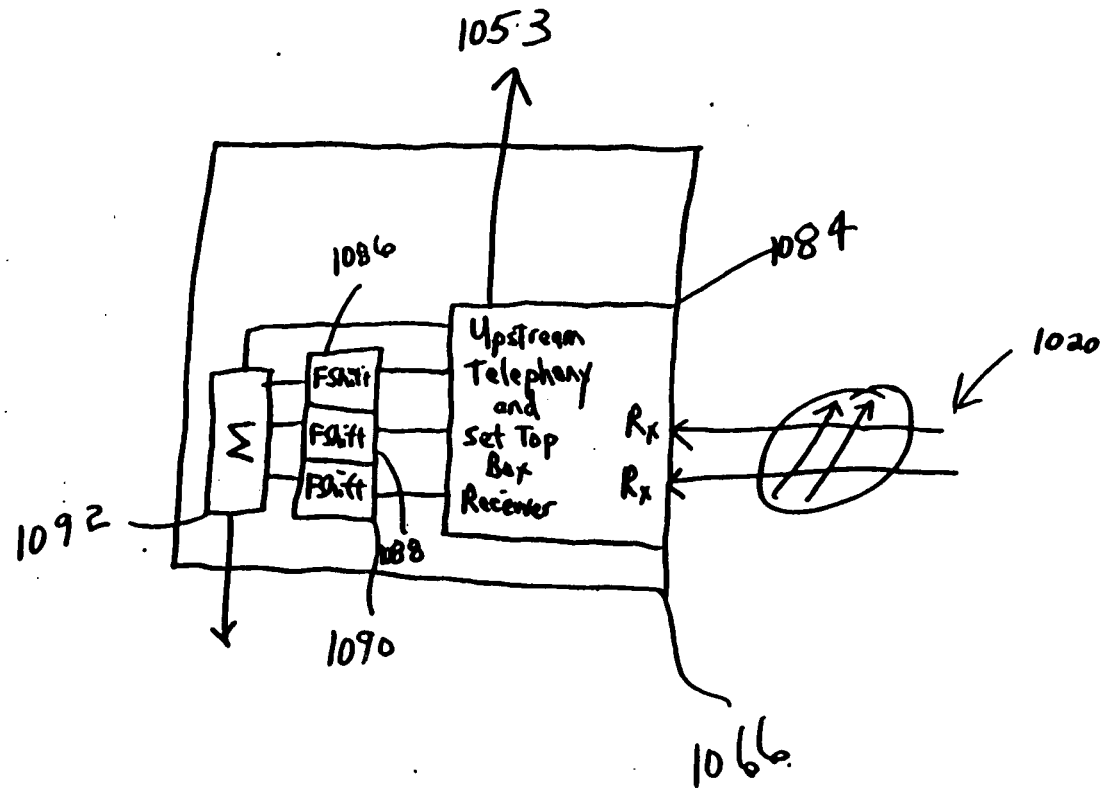

Upstream Information
SEQUENCER
1301
10 TAP FIR Filter
1302
Support Circuitry
1303
Raised COSINE PULSES

Figure 122



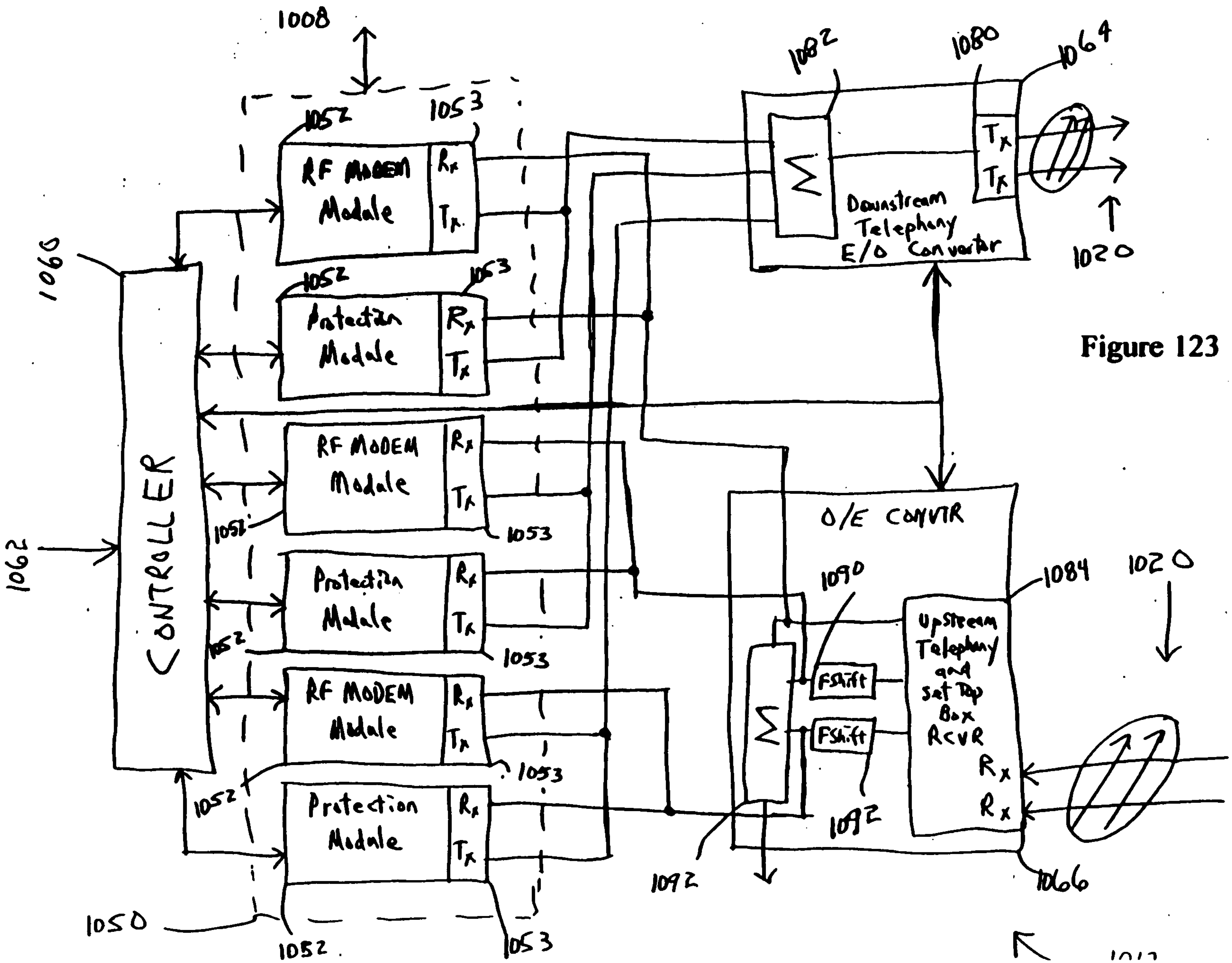

1008
1052
1053
RF MODEM Module
Rx
Tx
Protection Module
RF MODEM Module
Protection Module
RF MODEM Module
Protection Module
CONTROLLER
1060
1062
1050
1082
1080
1064
Downstream Telephony E/O Converter
1020
O/E CONVTR
1090
1084
Upstream Telephony and Set Top Box RCVR
FShift
1092
1066

Figure 123